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Electrical World

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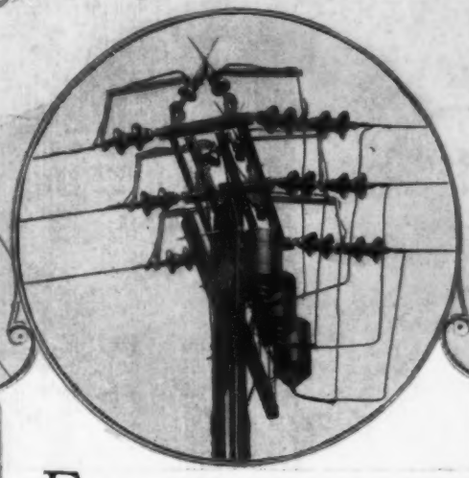

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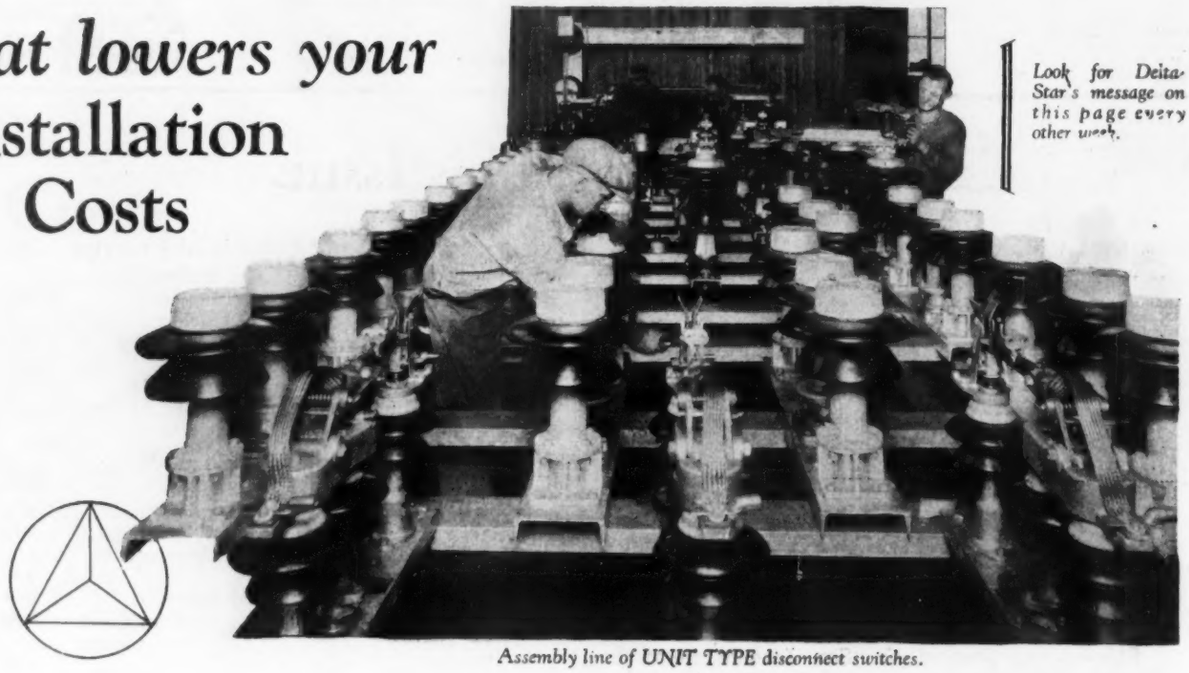

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W. H. ONKEN, JR.
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Sales and Man Power

EXPERIENCE indicates that intensive sales efforts produce best results. A large number of competent salesmen with a small number of prospective customers per salesman permits a degree of customer cultivation which results in maximum sales volume. In many cases, however, conditions are such that this policy must be modified seriously. A utility company may operate in a widespread territory where the income of the customers is limited. Again, competent salesmen are difficult to obtain and to retain unless they are paid a return greater than is warranted by the sales made. Thus the generalized statement on sales and man power is subject to modification in practice, but the principle is sound and should govern the development of sales programs.

The campaign method of sales or the use of specialty salesmen must be judged partly from this standpoint. A large group of refrigerator salesmen, for example, may be needed to sell the quota established for the sales period. It is a problem to get the men, and a still bigger problem arises at the end of the campaign period. A permanent sales staff is desirable, but large groups of specialty men are difficult to hold profitably during unseasonal sales periods or to adapt for selling general appliances. The summer campaigns create a heavy demand for salesmen, but the winter season calls for retrenchments and a slackening of some sales efforts.

These points are doubtless kept in mind by utility sales managers in their efforts to stabilize the situation. Any individual plan for a single property must consider the man-power situation carefully and has to operate on the fundamental conception of building a permanent staff of salesmen who sell continuously and intensively.

Power and Light Bonds Underrated

CURRENT heavy buying of power and light bonds indicates a growing appreciation of the high investment quality of these issues. Investors are realizing more extensively that these bonds are comparable in security with bonds of lower yield, such as those of the steam railroads. A rigorous comparison of the security behind the two classes fails to disclose any adequate reason for the difference between a 4 per cent and a 5 per cent coupon rate. The explanation, of course, is that the power and light industry is younger and that habits of thought on the part of the investing public, and even of financial houses, set up an artificial distinction. The same habits of thought are responsible for legal discrimination regarding suitability of such securities for trust and savings-bank investment in most of the states. This may be a more direct reason for the price difference.

Junior securities of light and power companies have an enviable earning record. The companies are enjoying rapid growth. It may be charged that the capital structures are in many instances more or less unbalanced, but so are those of the railroads. With the latter in many cases interest-bearing securities form too large a percentage of the total. This criticism is scarcely applicable to the power companies. The railroads, of course, are doing very little borrowing. While the power companies are heavier borrowers than ever, certain definite restrictions prevent any weakening of the security. Despite the existing demand for electric light and power bonds, the industry has much educational work to do before the public in general recognizes what attractive investments they are.

The Massachusetts Rate Situation

TO THE accompaniment of glaring headlines a campaign in legislative circles sponsored by Governor Fuller and Representative Shattuck for lower maximum electric service rates is proceeding in Massachusetts. So much political smoke is ascending skyward that it is difficult to get clear temperature readings of public and official opinion, but certainly nothing in sight indicates that a financial explosion is imminent. From the opening days of the legislative session the light and power companies have indicated their willingness to co-operate in any sane and unbiased investigation into the equity of existing rates. The Department of Public Utilities is functioning as usual in regulative channels.

Unfortunately certain public officials seem to find the regular processes of inquiry too slow for their political tempo, and a widespread attack upon maximum electric rates has been launched. Off-hand opinions have been requested from the department by men who should know better, and long lists of names of companies have been handed to the press by the Governor with tabulations of drastic reductions in rates. These appeals to newspaper publicity are giving many readers the idea that the power companies are on the trail for swollen profits, and as usual too much is being made of the rates of dividends declared in percentages on 100 par. The situation is not yet acute as regards public opinion, but is unfortunate in its handling by Beacon Hill.

In a sense many Massachusetts companies are the victims of a state policy to which they have long and too faithfully adhered. For decades surplus earnings have been plowed into plant, and many companies are amazingly undercapitalized. Dividend rates, including extras, have in some cases exceeded 40 per cent, but on total capital and premiums representing probably one-fourth or less of the reproduction cost of the property. When the latter rate base is computed, the earnings take on a very different aspect.

No management of vision and ability overlooks the powerful influence of lower rates in load building, and few indeed are the intelligent executives who seek to develop business by raising the prices of their service except in cases where thorough economic analyses

justify such action. Unprofitable power contracts have been renewed on the basis of higher rates in some cases, and increased costs have sometimes forced moderate upward readjustments even in maximum rates, but the whole trend of the light and power industry is toward lower prices. It may be found on careful inquiry that some Massachusetts companies can bear, nay, profit by, moderate reductions in rates, and especially by instituting compound rates with relatively low energy components for residential rates. Many reductions have been announced this month, some of which were planned last fall or before. The time is ripe for determining once and for all whether the Massachusetts policy of undercapitalization should not give way to a capitalization more closely approaching the value of the property from the standpoint of the Supreme Court, but such problems demand arduous study by men wise in their application and should never be subjected to less than expert investigation and solution.

Six Things to Do in the Supply Field

IN THE discussion that is going on among electrical men concerning the present perplexities in distribution of supplies a very natural question is being asked. It is easily admitted that there are maladies to be cured. It is freely conceded that a strong personal leadership in the jobbing field by a man authorized to speak for distribution might have great influence for good. And the opinion is voiced from all sides that if the Electrical Supply Jobbers' Association would establish a president, who could take his place in the councils of the electrical industry, much might come of it. But the question is what should be done.

No man can step forward and solve all these distribution problems by a lordly gesture, nor could a superman. But a strong official leader representing all the jobbers—the "independents" and the "groups"—could and naturally would proceed to break down the situation into its elements and go to work to better these six conditions:

1. The jobber has suffered much from an inferiority complex. Rapid evolution in the electrical industry has wrought considerable havoc in his business, and painful readjustments have been necessary. It has become the habit to call him a middleman and wonder how long he can survive. It is about time that the vital importance of distribution to all electrical men be understood and appreciated and that the jobbers' function be glorified a bit.
2. There are economic laws of distribution that no man may disobey without paying the cost. These laws should have clear interpretation to the jobber himself and to the other branches of the industry. Some of these principles need a lot of "selling."
3. The jobber today has no complete industry statistics on costs, stocks, sales, prices and the other lawful information without which he cannot fully know his market nor what his own costs ought to be. A big job can be done here.
4. Many manufacturers are straddling the jobber, using him and competing with him too, expecting him to build their market, yet taking the business from under his nose. The jobber must define his place in this relationship and either qualify or not.
5. Certain power-company business has left the jobber because of purchasing by holding companies, but the jobber has a valuable service to sell the central station in the selection, purchasing and local warehousing of appliances. It will require a united industry and strong guidance to win acceptance for this idea.
6. The jobbers can do much to bring the contractor and dealer to economic health and greatly benefit themselves. Better control of credit and discounts will result in fewer curbstoners and fewer semi-jobbers. The situation needs policies, generally accepted.

There is much that a militant leader could do for supply distribution in the industry. There are many jobber executives eligible and competent to carry the banner. There is ample membership at present both in and out of the E.S.J.A. to support the work. And it is vital alike to electrical manufacturers, power companies, contractors, dealers and the jobbers themselves that these issues be challenged and conquered.

Better Railroad-Station Lighting Is in Prospect

NEW interest among progressive railroad men in improved station lighting is gratifying from every point of view. Within the next few years we shall see real competition between rolling-stock and station departments on not a few roads for the best-lighted equipment. The old days—or rather nights—of dismal illumination of vehicles and waiting rooms occupied by the traveling public are giving way to new times in which the value of good lighting in public relations, in stimulating patronage and in making travel safer forms a keynote of transportation policy. There are still innumerable installations in service which are literally relics of the dark ages of railroad administration, but on the other hand new stations reveal that much time is being put on lighting problems by railroad electrical engineers. Of late a definite trend toward the betterment of lighting in old stations has marked the dawn of a new era in this long-neglected field.

Central-station engineers and railroad men are beginning to work together for better lighting of stations throughout particular areas in which the utilities they respectively serve operate. From the power company's standpoint, the business is of the long-hour type in many cases, although the load requirements of individual stations are often small and extremely variable in volume. Adequate lighting may mean the installation of at least two to six times the wattage now connected, but economical operation may be aided by subdivision of circuits. The basic requirement is naturally an intensity of illumination that will permit comfortable reading in waiting rooms during the hours that these are open. If this is not maintained, public hostility is liable to be aroused and patronage of the transportation company repelled. Travel in comfort appeals to a civilization reared on modern improvements and unfriendly to hardships. What has been done since the war in car-lighting betterment is bound to be duplicated in stations as engineers of power and railroad companies become acquainted and join hands for better service.

Upon the possibility of keeping costs down depends much in the immediate development of better railroad-station lighting. Recent conferences between utility engineers interested in this problem point to the desirability of establishing reasonably uniform designs and practices in handling groups of stations operated by a single railroad and served by a given group of power companies. On one road detailed studies are soon to be presented by the illuminating engineers of betterment in the lighting of a typical station of a syndicate whose lines reach probably half a hundred stations on the network of rails. From these studies and corresponding bills of material required it is hoped that a

comprehensive program of station-lighting betterment can be formulated. Quantity purchases of materials, more efficient organization of construction work, bids on stations singly or in groups, and relatively lower costs due to larger volume, should result. If a plan for group handling can be established which can be carried through without important changes after the work starts, executive approval in railroad circles for station-lighting betterment budgets will be much more easily obtained. The field is for practical purposes almost wide open, and prompt action is in order.

Isolation for Fire Fighting

FIRES are expensive and seriously affect electric service. Unfortunately, so long as oil and combustibles are used for insulation and so long as electrical energy behaves as it does there will always be fire hazards to trouble the industry. Progress in eliminating these hazards has, however, been made in the last few years. The principle of isolation has been used to good advantage in many parts of typical systems. In recent hydro-electric stations all apparatus containing oil has been placed outside the station structure. In metropolitan substations oil-filled equipment has been placed in fireproof compartments. Care in installation, precaution in handling oil and better inspection and maintenance of the oil have reduced the danger.

More recently the principle of isolation has been combined with methods of fighting fire. Placing any piece of equipment in a fireproof compartment reduces the fire hazard to the minimum, and fires originating in these isolated equipments can be extinguished by any one of several means. In some metropolitan substations all transformers and regulators are placed in separate compartments as well as in one fireproof room. Permanently located fire-fighting equipment is then installed which can be used in any compartment or in the room itself without risk to those who operate the extinguishing chemicals. Generators have been totally inclosed and extinguishing chemicals installed for flooding the machine in the event of a fire.

None of these more elaborate fire-prevention installations has been called upon to operate under service fire conditions, but the money spent and the precautions taken indicate the progress the industry is making and show that it is alert to every reasonable opportunity for reducing damage from fire.

Frailties and Virtues of Men and Machines

VIRTUES of automatic substation operation are rapidly coming into wide appreciation. The factors of safety, dependability and ability to perform specific functions in a predetermined manner and sequence have been developed by the best thought in both operating and manufacturing fields so that the use of automatic substations is now accepted as good practice.

Elimination of the human element has been one of the chief advantages claimed in behalf of automatic station operation. If consideration of the human element is limited to its fallibilities, its propensity to be lulled into slumber by the drone of machines, its uncertainty of reaction to emergencies, and its very common inclination to divided attention, then elimination of the human element is desirable. But the human element has its good points as well as its frailties. A man can go about a certain operation, discover part way through that a wrong condition has arisen, stop and correct the condition and make a new start. An automatic machine goes doggedly about its duty, and if anything goes wrong it either rides roughshod over the difficulty with no regard for good or bad consequences or it quits and retires to an inoperative state, callously unconcerned and indifferent.

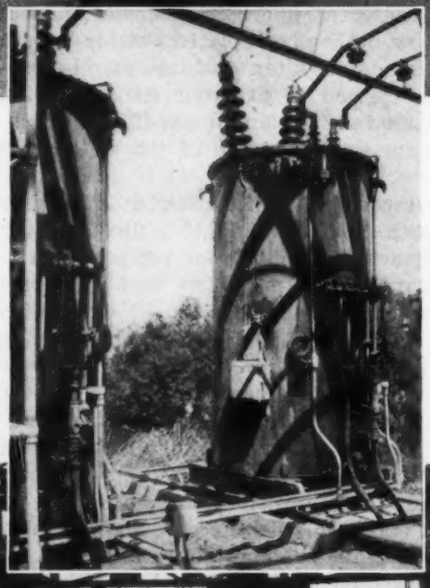
As man is prone to err so is material prone to failure. And as material things may be devised and arranged to perform definite functions, so man must be employed to observe and inspect these things and to correct their innate tendency to perversity. The problem in electricity supply systems is to combine the intelligence of the human element with the definite action of automatic control which cannot be disconcerted in emergencies. There are these four factors: Men make mistakes; machines fail; men can correct wrong conditions; machines never forget to do what they are designed to do. The problem is to remove as completely as possible the frailties of men and machines and to retain the virtues of both.

Lightning Protection Near

INSULATION against lightning or for relief therefrom has long been an engineering problem of first magnitude. Lightning is the system hazard which rests like a cloud on the horizon of utility operators. Insulation was the first approach to limiting the effects of lightning, but it has definite economic and practical limitations and a weak spot always remains. When the line is better insulated, then terminal equipments give trouble, and vice versa.

A sounder approach is to supplement the use of insulation by relieving the line of transients as quickly as possible. The technique of this task requires that engineers know the character of lightning and be able to measure it as to magnitude, energy content, wave shape and periodicity. Until the last year or two measurements were difficult to make and a more or less empirical method of relief was followed with more or less effective results as a consequence. Ground wires, arcing horns or rings and different types of arresters were installed and their merits debated. A multitude of opinions arose with few data to substantiate them.

During the last year or two data in abundance have been collected in the field, and laboratory instruments and measurements have been made. Lightning as a manifestation of electricity has been studied in detail, and more intelligently developed systems for lightning protection are certain to appear in a short time. Present practices in insulation and for relieving lines of lightning transients are ripe for improvement, even though they have been fairly satisfactory. Limitations in applications and practices can be stated, installations can be made more economically, and new developments can be carried through with the assurance that they will bring about improved system operation. In another year or two electrical engineers should be virtually free from troubles arising from lightning, for they now have the knowledge which will give them the power to control that natural phenomenon.

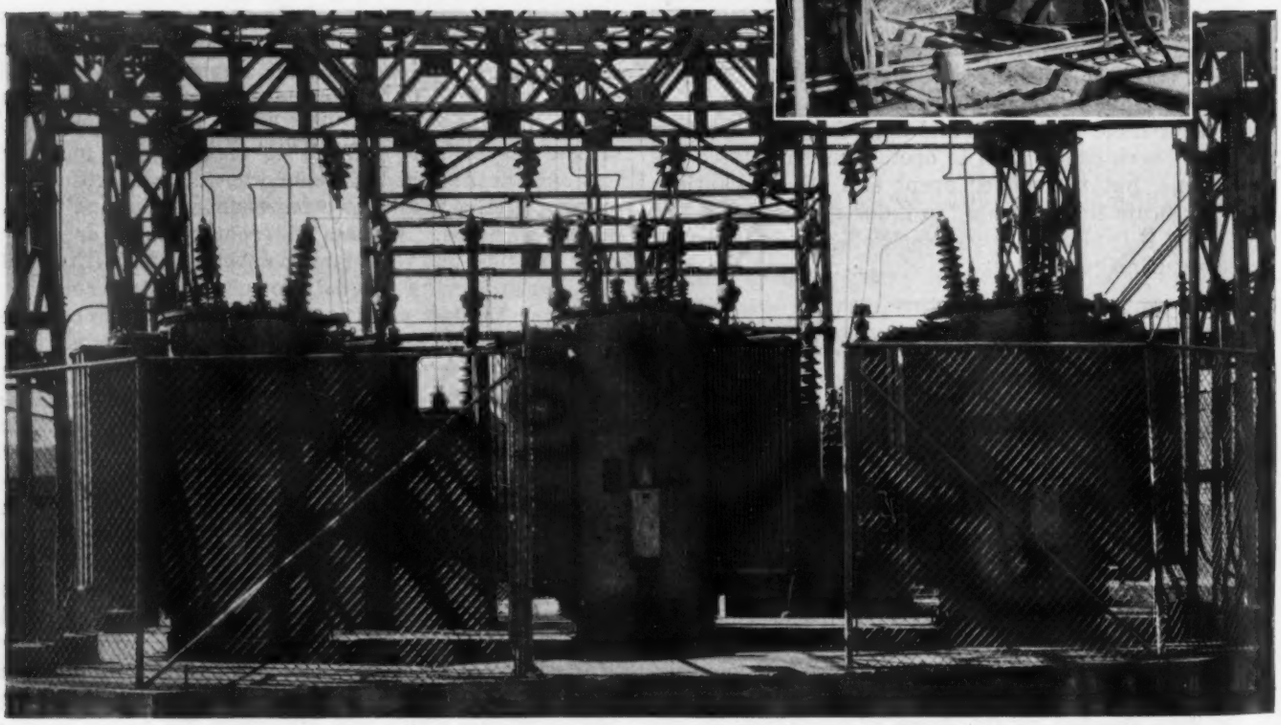


Courtesy of Westinghouse Electric & Manufacturing Company

Transformer with Inert Gas Over Oil

SINCE June, 1924, more than 300 power transformers with a total rating of 3,000,000 kva. have been provided with the "Inertaire" equipment to maintain above the oil a cushion of dry inert gas and to remove from the air breathed into the transformer oxygen and moisture. These units range in size from 333 to 25,000 kva. and are distributed among 35 operating companies in the United States, Canada, Italy and Japan. Service reports indicate that the oxygen content in these transformers is usually maintained below 1 per cent, which is well below the explosive limit.

A number of cases have been reported where internal trouble in transformers might have resulted disastrously, but which were handled by the protective feature. Among these were failures of coils due to lightning and to wrong connections and bushing failure under the oil.



Flexibility in Outdoor Substation Construction

Step-by-Step Plan of San Joaquin Light & Power Corporation Provides for Future Growth—Types of Structures Reduced to a Minimum

By C. E. SCHNELL
Designing Electrical Engineer
San Joaquin Light & Power Corporation, Fresno, Cal.

OUTDOOR substations with sufficient flexibility to admit of expansion readily as load increases is the end toward which all central-station engineers are working. Future requirements of any particular substation cannot be foretold, but special effort should be made to provide for growth and expansion as to both transformer capacities and transmission and distribution circuits. As engineering is to get the greatest value for every dollar expended it is necessary to give this look into the future in order that what is done today may fit into what will be necessary at a later date with the least possible change and expense and interruption to service. The general trend of substation design and construction has been from the wholly indoor type to the wholly outdoor type, with such accompanying refinements as to give greater flexibility of operation, greater clearances and better appearance. This discussion will be confined to the outdoor-type substation involving such voltages as 110 kv. and 70 kv. for transmission and 11 kv. for distribution and serving mostly small towns and farming communities.

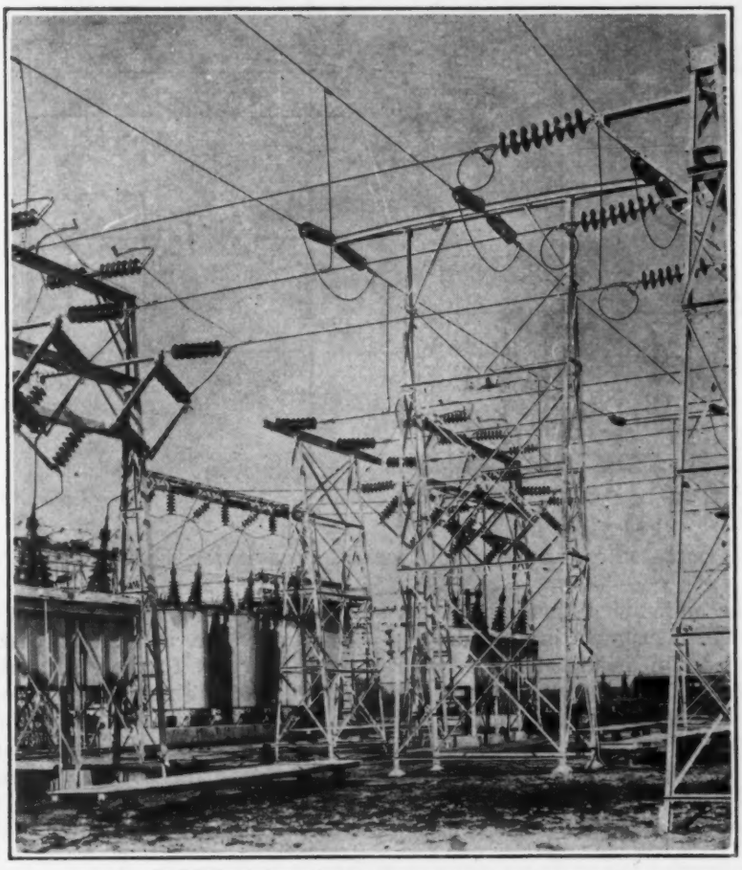


FIG. 1—HIGH-TENSION BUS CONSTRUCTION OF SAN JOAQUIN LIGHT & POWER CORPORATION

On the system of the San Joaquin Light & Power Corporation certain types of construction that are believed to have merit have come into general use. For transmission voltages of 110 kv. and 70 kv. a suspended bus between towers with each tower a unit by itself is used (Fig. 1).

These steel towers have been reduced in type and number to a minimum, so that each substation layout is sort of a game of checkers in which the various towers are moved about to suit the needs as to number of transmission lines, transformer banks, etc., so located as to give the best feeder gateway. For distribution voltage a pipe structure has come into use, so arranged as to be a complete outdoor substation with necessary high-tension switches, transformers, regulator, main and transfer bus and any number of feeder switches necessary. Such substations are fed from the 11-kv. system and radiate 4-kv. feeders. The substation shown in Fig. 8 is typical of this type. Details of substations of this class will be given in a subsequent article.

To illustrate the development of a transmission substation from its simplest form into something more elaborate several examples will be cited. A substation in its simplest form is one where an 11-kv. line of large capacity is run from a main substation to a point where it is desired to split the circuit into independent feeders in several directions, each with a circuit breaker. Fig. 3 illustrates a substation of this type where there is no attendant and where each feeder in case it trips out is automatically reclosed.

The next step in the layout of this substation is the installation of a bank of transformers with the transmission line constructed as a stub line from the nearest substation on the main transmission system. There will be no operator at this station after the transformer bank is installed, and the circuit breaker protecting

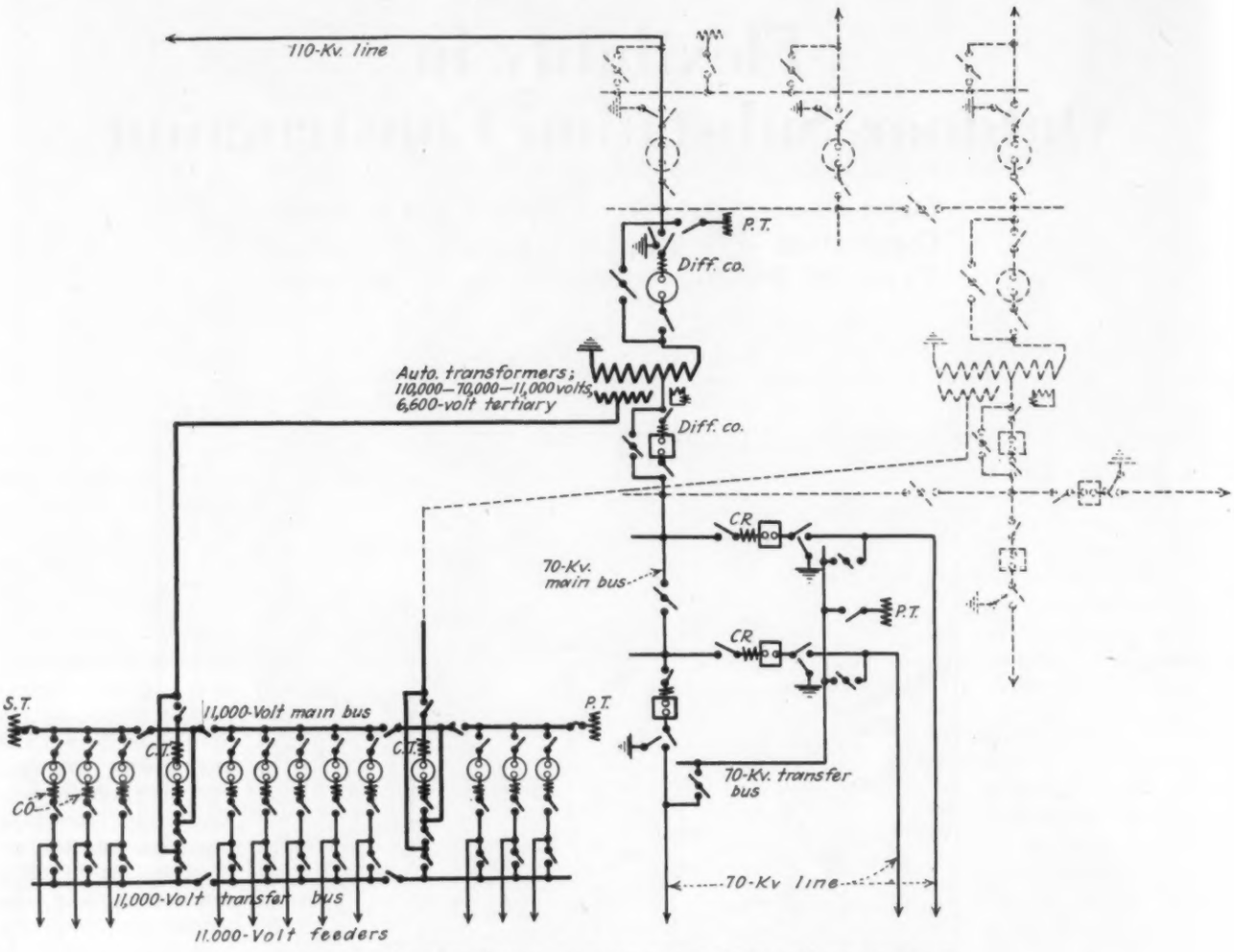
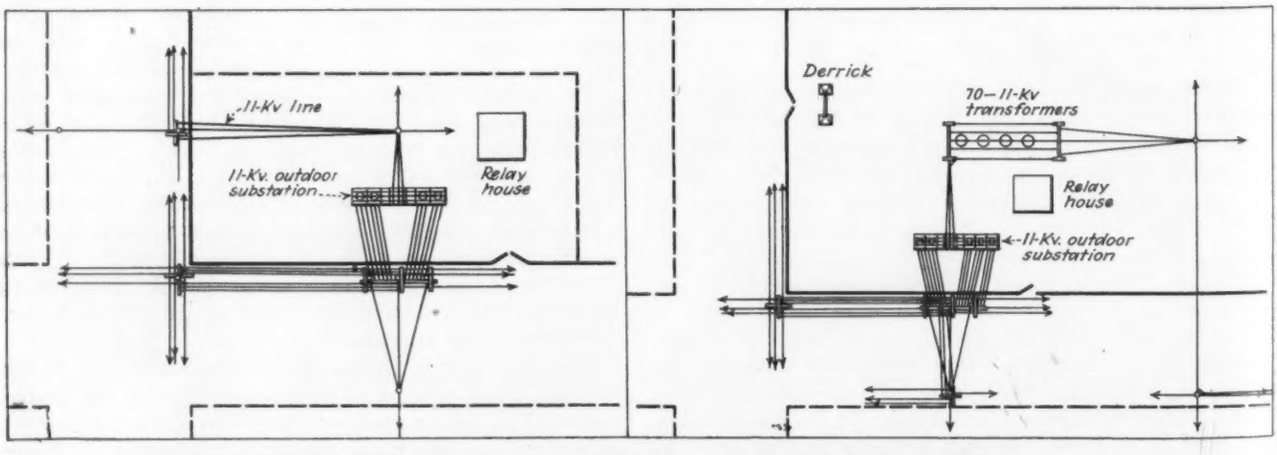


FIG. 2—SINGLE-LINE WIRING DIAGRAM OF SUBSTATION SHOWN IN FIG. 8

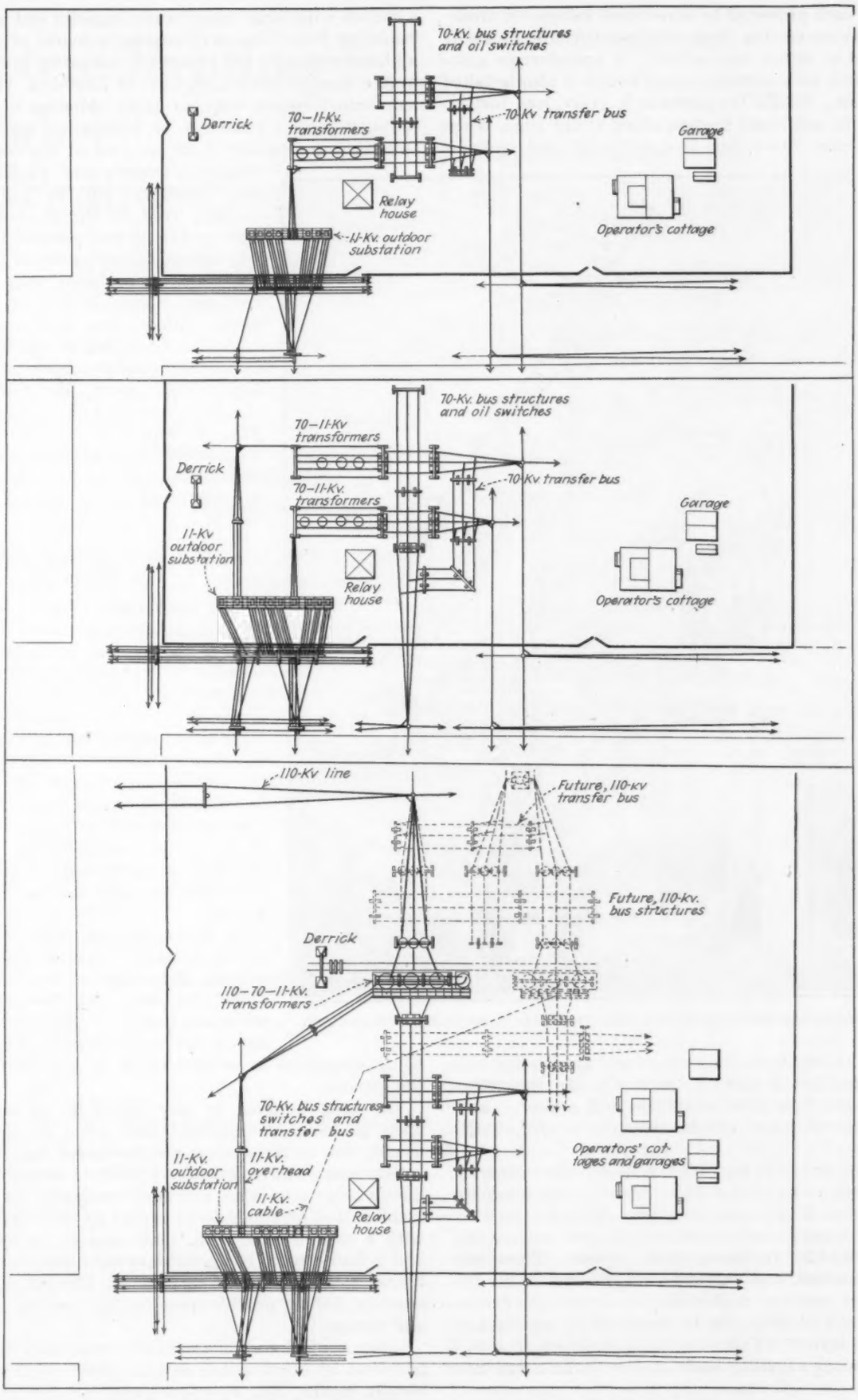
the bank is located at the main substation, where there is an operator on duty. An example of this development is the Elk Hills substation in the oil fields, where there is a bank of three 1,500-kva. transformers with the transformer automatic switch located at Taft substation, twelve miles away. Four 11-kv. circuits radiate from here, each circuit being protected by an automatic reclosing circuit breaker. The alarm circuit for any feeder in trouble is the telephone line, which notifies the operator at Taft. Several substations of this type are in service, and the success of this scheme is such as to warrant further installations. Fig. 4 shows the addition of the transformer bank.

Such a substation with increasing load and importance will sooner or later warrant the construction of another transmission line to provide a two-way feed and avoid interruption to service. This is accomplished by the addition of line switches for both the old and the



FIGS. 3 AND 4—FIRST AND SECOND STAGES IN SUBSTATION DEVELOPMENT

At the left, a heavy 11-kv. circuit branches into several 11-kv. feeders protected by oil circuit breakers. At the right, a 70-kv. line and bank of transformers have been added. There is no attendant at this station.



FIGS. 5, 6 AND 7—THIRD, FOURTH AND FIFTH STAGES IN SUBSTATION DEVELOPMENT

Top—A second 70-kv. line has been added with the necessary switches, etc. An operator is now employed to attend this station. Center—Transformer capacity is increased and additional 11-kv. feeders are provided in the fourth step. Bottom—Transmission voltage is increased to 110-kv. and the substation reaches its fifth stage. Each addition makes use of previous equipment and layout.

new line, each protected by directional relays. A transfer bus for connecting these two lines permits the ready inspection of either line switch. A transformer automatic switch with suitable bypass switch is also installed at this time. Should the increase in 11-kv. load justify, there can be additional feeders added at any time. When the additional 70-kv. line is constructed and switches

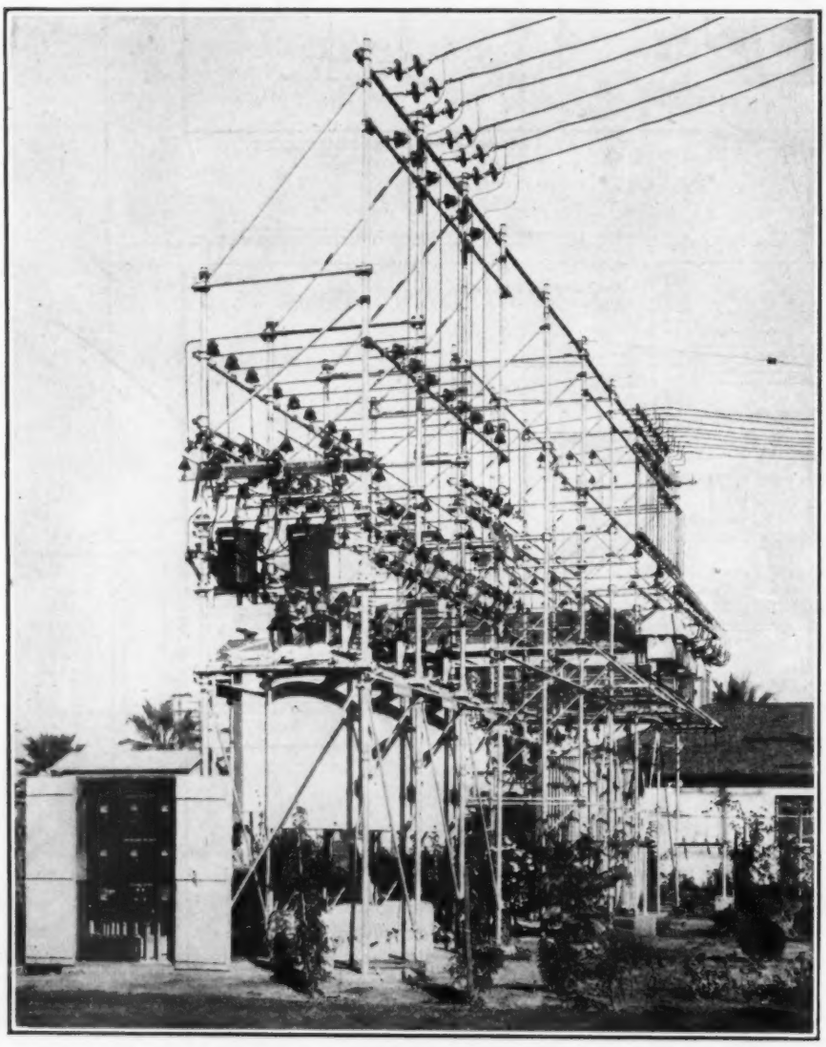


FIG. 8—PIPE-FRAME SUBSTATION CONSTRUCTION FOR 11-KV./4-KV. DISTRIBUTION

are added, a standard-type cottage and garage are built and an operator is hired to supervise the substation. Fig. 5 shows how this substation will appear. Most substations on main transmission lines are of this same type.

The next step is to increase the transformer capacity, which means an additional 70-kv. transformer automatic switch and an 11-kv. master switch. With the need for additional transformer capacity will also undoubtedly come the need for increased 11-kv. feeders. These may be readily added, and perhaps an additional 70-kv. line also may be required at this time to tie into the system network. All of these can be cared for by merely adding to the layout. This substation is shown in Fig. 6 and is typical of many such stations which are now in service.

With the exception of the possibility of adding another 70-kv. line if needed at a later date, the next step is to increase the transmission voltage to 110 kv., as a station with large transformer capacity and numerous radiating 70-kv. lines will warrant a source of supply at a higher voltage. The plan with this set-up is to install, first, a bank of four 5,000-kva. or 7,500-kva. 110/70-kv. auto-transformers, with an 11-kv. winding of suitable capacity (either 2,500-kva. or 3,750-kva.) and a 6,600-volt tertiary winding of 20 per cent of the capacity of the main transformer winding. Such an installation will, of course, give suitable feed to the existing 70-kv. lines and in no way changes them, but will permit the salvaging of the existing transformer banks with their oil switches. Later, if desired, an additional 110-kv. line and transformer bank can be added to the same site by using the same scheme as outlined for the 70-kv. lines. Fig. 7 shows one of the 110/70/11-kv. substations. Fig. 2 shows a one-line wiring diagram of the completed substation, which may be added to or taken from as illustrated in the ground plan of Fig. 7.

TYPES OF STEEL TOWERS USED ARE MINIMIZED

One interesting feature that this type of construction has developed is a minimum number of types of steel towers. For example, in 70-kv. substation construction the buses are either 19 ft. or 24 ft. from the ground. Over an oil circuit breaker disconnect switches are always used, and a bypass air switch may or may not be used. All this can be taken care of by one type of structure by means of which buses may be suspended at either of the heights mentioned, or the structure may be used for an oil-switch tower.

A tower of this type is termed a "handy-andy" structure, as it constitutes 50 per cent of the 70-kv. steel structures used. For the 110-kv. bus structure towers of the same general design are used, buses at this voltage being suspended at heights of 24 ft. and 33 ft. above the ground.

The area occupied by any substation is dependent upon probable development and price of land, but usually one to three acres are purchased for 70/11-kv. substations and five acres for 110/70/11-kv. substations. Such a large area is not absolutely necessary, as recently a substation arranged to be served by two 70-kv. lines, with a bank of 4,500-kva. total capacity transformers and a four-circuit 11-kv. outdoor substation with relay house, was constructed upon a lot 100x150 ft. This, however, did not provide space for the operator's cottage and garage.

Other central-station companies are answering their problems by other means and in other ways. All have certain merits, but experience over several years has amply justified the method as outlined here both as to the first cost and as to the cost of making extensions.

Electric Heating Sales Organization

By ODIN WILHELMY
Industrial Heating Division, Union Gas & Electric Company, Cincinnati, Ohio

How the Power Company Should Analyze Load Possibilities of Its Territory and Set Up a Sales Engineering Division to Develop Industrial Electric Heating—Importance of Relations with Equipment Manufacturers and Service to Users

ALMOST every industrial plant offers possibilities for some application of industrial electric heating. In the past eight years there have been developed a number of standard forms of thoroughly dependable and highly efficient electrical equipment, which can be used in a variety of present-day industrial heating operations. The question of equipment for any particular purpose is, therefore, quite well taken care of. New and additional equipment can and will be designed and constructed as the need arises.

Nearly all industrial heating operations fall under some division of the following list of applications for which suitable electrical equipment now exists or can readily be designed:

1. Metal melting:
   a. Steel and iron.
   b. Brass and copper.
   c. Nickel alloys.
   d. Aluminum and magnesium.
   e. White metals.
2. Furnaces operating at temperatures above 1,000 deg. F.:
   A. Heat-treating:
      a. Normalizing.
      b. Annealing.
      c. Carburizing.
      d. Tempering.
      e. Forging.
   B. Vitreous Enameling:
3. Ovens operating at temperatures up to 1,000 deg. F.:
   a. Japanning.
   b. Core baking.
   c. Glass annealing and firing of decorated glassware.
   d. Bread and cracker baking.
   e. Sherardizing.
   f. Roasting machines.
   g. Shoe conditioning.
   h. Compound and grease melting.
   i. Miscellaneous baking and drying operations.
4. Commercial Cooking.
5. Small Unit Applications:
   a. Cartridge units.
   b. Immersion heaters.
   c. Space heaters.
   d. Clamp-on heaters.
   e. Standard small units, such as glue pots, hot plates, soldering irons, etc.
6. Electric welding.
7. Rivet heating.

UNIVERSITY OF CINCINNATI
COLLEGE OF ENGINEERING AND COMMERCE

November 27, 1926.

The Members of The Engineers Club:

Mr. W. B. Wallis, of Pittsburg, Pennsylvania, will give a lecture and demonstration on "The Electric Furnace in Indust--", in McMicken Auditorium, on Wednes--, December 1, at 8:00 P.M.

I extend to you and to any of the men in your organization who might be interested, a cordial invitation to attend this lecture as the guests of the University.

A fifty-pound ladle-type furnace will be in actual operation on the stage. The installation will be made through the courtesy of The Union Gas & Electric Company. The lecture will be illustrated by slides.

Mr. Wallis is President of The Pittsburg Electric Furnace Corporation. He is a nationally known authority on Electric Furnaces, and he has lectured throughout the country to groups of industrial and technical executives and at a number of universities.

In his talk he will emphasize the following points:

1. The direct manufacture of steel from pig iron.
2. The duplexing process.
3. The triplex process.
4. The application of the electric furnace in the melting of steel.

I hope you will find it possible to accept this invitation, as I am sure that Mr. Wallis' lecture will be both interesting and instructive.

Very truly yours,

H Schneider

Dean,
College of Engineering & Commerce

EXAMPLE OF CO-OPERATION WITH ENGINEERING SCHOOLS

8. Heat applications in electrochemical and electrometallurgical processes:
   a. Aluminum and other metals.
   b. Abrasives.
   c. Calcium carbide.
   d. Cyanamide.
   e. Carbon bisulphide.
   f. Ferro-alloys.
   g. Graphite.
   h. Nitrates.
   i. Phosphorus.

Perhaps there are single applications that will be electrified from time to time that do not fall under the preceding classifications, but even as it stands, the field is sufficiently large for the development of a tremendous electric heating load. The ELECTRICAL WORLD, in the issue of May 8, 1926, made an analysis of the potential industrial electric heating load, which showed that the present installed capacity of industrial electric heating equipment is only 1,313,000 kw., whereas there is an available additional load of 42,992,000 kw. This is exclusive of commercial electric cooking, for which there is a possible market of 2,576,200 kw.

In 1925 one heating equipment manufacturer alone sold 100,000 kw., not including arc or resistance-welding equipment or arc-furnace equipment. This manufacturer estimates that this 100,000 kw. will use 200,000,000 kw.-hr. at an average rate of 2 cents per kilowatt-hour. This one year's sales by this manufacturer alone would produce revenue to the central station of $4,000,000. The value of this load to the individual power companies is shown in the accompanying tabula-

SALE OF ELECTRICITY DURING 1925 FOR INDUSTRIAL HEATING AND COMMERCIAL COOKING PURPOSES

	Kw.	Kw.-Hr.	Revenue
The Detroit Edison Company	55,500*	150,000,000*	.....
Northern States Power Company	850	2,040,000	$49,800
Pacific Gas & Electric Company	2,400	6,000,000	96,000
Pacific Heavy-Duty Cooking	1,800	250,000	25,000
Puget Sound Power & Light Company	3,000	4,400,000	55,300
Union Electric Light & Power Company	11,625	.....	.....
Union Gas & Electric Company	8,000	13,730,000	242,000
Public Service Company of Colorado	2,227	3,900,000	7,200
Tennessee Electric Power Company	12,470	47,606,000	329,869
Consolidated Gas, Electric Light & Power Company	2,900	7,250,000	107,000
United Electric Light & Power Company	4,444	4,431,000	150,000
Edison Electric Illuminating Company of Boston	12,500	14,000,000	220,000
Total added	50,591	103,607,000	$1,282,169
*Not included in addition	67,125	150,000,000	.....

tion, showing the connected load and energy consumption of industrial heating and commercial cooking equipment connected to the lines of twelve representative electric utilities.

These figures indicate the magnitude of the industrial heating load, and it should prompt every central-station company to establish some definite means in its electric sales department to make at once a complete and thorough study of its territory in order to determine the available business in industrial heating applications and to take steps to get this load on its lines.

The first step in developing the industrial electric heating load is the establishment of an industrial heating division of the sales department, the chief duties of which are to get the electric heating load on the lines of the company and to keep it there. In order to function properly, the division must be composed of the correct personnel; men must be properly trained and they must know the territory they serve. There must be a definite sales promotion plan and there should be a permanent organization, the number on the staff depending upon the requirements of the work in hand.

Industrial Heating Survey Data Sheet
Union Gas & Electric Company

1. Name.....Business.....
2. Address.....
3. Power Supplied by.....
4. Process.....
5. Material.....
6. Number of Units.....Kind of Equipment.....Size.....
   Kilowatt Capacity.....
7. Kind of Fuel.....
8. Amount of Fuel Used per Month.....
9. Operating Temperature, Max. Temp.....
   Mean Temp.....
10. Pounds of Product, Per Hour.....
    Per Month.....
11. Maximum Production.....Pounds per Month During Month of
    .....
12. Per Cent of Product Rejected.....
13. Hours of Use.....A.M. to.....P.M. Total Hours per Week.....
14. Condition of Equipment, Good.....
    Fair.....
    Poor.....
15. Remarks.....
    .....
    .....
16. Information Given by.....Position.....
    Date.....Reported by.....
    Checked by.....

FORM USED FOR COLLECTING DATA ON PROSPECTIVE ELECTRIC HEAT APPLICATIONS

A properly qualified sales engineer, either from within or without the sales organization, should be selected to head this division and assume responsibility for the development of the electric heating load, under the direct supervision of the sales manager. To be properly qualified, this individual should have a well-rounded and fundamental technical education along mechanical, electrical, chemical and metallurgical lines. He should have the ability to gather facts and figures and to compile them into comprehensive and convincing reports. He must have versatility, sales ability, vision and enthusiasm, in order to overcome the resistance to the general adoption of electric heat.

The man who is to head an industrial heating division should undertake specialized training along these lines. He should attend the industrial heating schools conducted jointly by the National Electric Light Association and electrical manufacturers. Intimate contact with electric heating equipment manufacturers should be fostered, and the heating engineer should familiarize himself with all available equipment for electric heating purposes. The information and contacts gained by inspecting and studying all kinds of existing electric heating installations throughout the country are of great value. National Electric Light Association publications and technical and trade journals should be carefully searched for any articles relating to the development of electric heating applications. All available data should be gathered and studied for use in selling similar installations locally. In any development that is progressing as rapidly as the application of electric heat to industrial uses, it is most important that the individual responsible for the promotion of this business keep himself posted on all the latest developments and improvements in the field and this entails constant study on his part.

SURVEY OF TERRITORY

The character and number of the personnel of the industrial heating division depends, in a large measure, upon certain factors, namely:

1. The number and size of the industrial customers served by the company.
2. The size of the territory.
3. The time limit set for completing the survey.
4. The thoroughness with which the survey is to be made.
5. The plan for following up and capitalizing on the information gained in the survey.

Knowing the number and size of their industrial customers and the size of the territory over which the customers are spread, each company must decide how thoroughly the field should be covered in determining present and potential heating load. Surveys that contemplate only the superficial gathering of statistics have been very satisfactorily made by crews of college students employed during summer vacations. The contact of the college students with the men of the industries will naturally result in some publicity and the spreading of propaganda, but very few actual load

increases will result directly from their efforts alone. There must be an intelligent follow up. The real productive work must come after reports on electric heating possibilities are presented to the industries.

Another plan for a survey is simply to have the one man in the heating division make a superficial survey of some of the principal industrial plants in the territory that are most likely to have a substantial heating load, spreading propaganda as he goes and covering the ground in the shortest possible time. Such a survey will indicate whether or not there is sufficient heating load available to justify a permanent heating division and just how much time, effort and money should be spent in getting the load on the lines.

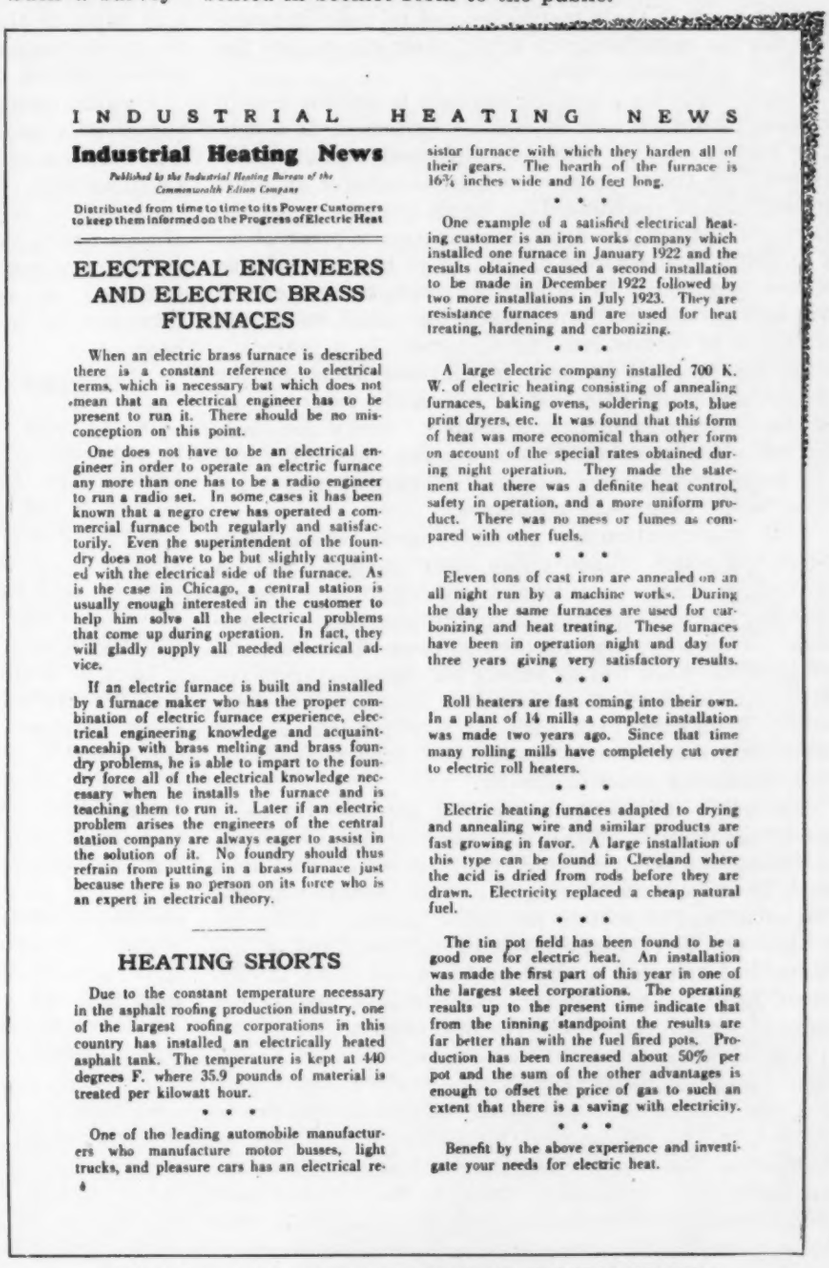
Where the second plan has been used, it has frequently been the experience that the heating engineer will create sufficient interest among prospects during the survey that the survey work is temporarily given up while actual heating load is being developed. Progress on the survey soon lags and real sales effort begins to occupy most of the heating engineer's time. Completion of the survey is important, however, and one or more assistants should be provided so that survey work and sales work can go along together without slighting either. With this arrangement an industrial heating division will more than pay its way as it goes along.

In making a survey of the heating applications in any plant, the heating engineer must first interview one or more of the officials of the manufacturing company and obtain their permission and co-operation in obtaining data. The manner of this initial approach by the heating engineer is very important in putting electric heat across and calls for considerable salesmanship and tact on the part of the heating engineer.

After the heating engineer has sold himself and the idea of the survey to the proper company official he will most likely be turned over to the superintendent or one of the foremen to assist in the gathering of the desired information. This can be collected most completely, most accurately and in the shortest space of time if the surveyor uses a form sheet on which to enter the survey data. Such a sheet is shown in the illustration on page 294.

The statistics that have been gathered during the survey have little sales value until they are tabulated, co-ordinated and compiled into comprehensive reports to the individual industrial plants. The preparation and presentation of these reports should be the duty of the head of the division. The reports should cover present costs on heating applications, compared with probable costs when the same operations are electrified. Often these reports can be made in conjunction with reports of the other divisions of the sales department. Therefore the heating division should work in close contact with them.

Reports should be as complete as possible and all statements should be backed up by established facts. Ultra-conservatism must be avoided as well as superoptimism, for either characteristic would be detrimental to the sales value of the report. The economic analyses compiled by the Union Gas & Electric Company are presented in booklet form to the public.



INDUSTRIAL HEATING NEWS

Industrial Heating News

Published by the Industrial Heating Bureau of the Commonwealth Edison Company

Distributed from time to time to its Power Customers to keep them informed on the Progress of Electric Heat

ELECTRICAL ENGINEERS AND ELECTRIC BRASS FURNACES

When an electric brass furnace is described there is a constant reference to electrical terms, which is necessary but which does not mean that an electrical engineer has to be present to run it. There should be no misconception on this point.

One does not have to be an electrical engineer in order to operate an electric furnace any more than one has to be a radio engineer to run a radio set. In some cases it has been known that a negro crew has operated a commercial furnace both regularly and satisfactorily. Even the superintendent of the foundry does not have to be but slightly acquainted with the electrical side of the furnace. As is the case in Chicago, a central station is usually enough interested in the customer to help him solve all the electrical problems that come up during operation. In fact, they will gladly supply all needed electrical advice.

If an electric furnace is built and installed by a furnace maker who has the proper combination of electric furnace experience, electrical engineering knowledge and acquaintanceship with brass melting and brass foundry problems, he is able to impart to the foundry force all of the electrical knowledge necessary when he installs the furnace and is teaching them to run it. Later if an electric problem arises the engineers of the central station company are always eager to assist in the solution of it. No foundry should thus refrain from putting in a brass furnace just because there is no person on its force who is an expert in electrical theory.

HEATING SHORTS

Due to the constant temperature necessary in the asphalt roofing production industry, one of the largest roofing corporations in this country has installed an electrically heated asphalt tank. The temperature is kept at 440 degrees F. where 35.9 pounds of material is treated per kilowatt hour.

• • •

One of the leading automobile manufacturers who manufacture motor busses, light trucks, and pleasure cars has an electrical resistor furnace with which they harden all of their gears. The hearth of the furnace is 16¾ inches wide and 16 feet long.

• • •

One example of a satisfied electrical heating customer is an iron works company which installed one furnace in January 1922 and the results obtained caused a second installation to be made in December 1922 followed by two more installations in July 1923. They are resistance furnaces and are used for heat treating, hardening and carbonizing.

• • •

A large electric company installed 700 K. W. of electric heating consisting of annealing furnaces, baking ovens, soldering pots, blue print dryers, etc. It was found that this form of heat was more economical than other form on account of the special rates obtained during night operation. They made the statement that there was a definite heat control, safety in operation, and a more uniform product. There was no mess or fumes as compared with other fuels.

• • •

Eleven tons of cast iron are annealed on an all night run by a machine works. During the day the same furnaces are used for carbonizing and heat treating. These furnaces have been in operation night and day for three years giving very satisfactory results.

• • •

Roll heaters are fast coming into their own. In a plant of 14 mills a complete installation was made two years ago. Since that time many rolling mills have completely cut over to electric roll heaters.

• • •

Electric heating furnaces adapted to drying and annealing wire and similar products are fast growing in favor. A large installation of this type can be found in Cleveland where the acid is dried from rods before they are drawn. Electricity replaced a cheap natural fuel.

• • •

The tin pot field has been found to be a good one for electric heat. An installation was made the first part of this year in one of the largest steel corporations. The operating results up to the present time indicate that from the tinning standpoint the results are far better than with the fuel fired pots. Production has been increased about 50% per pot and the sum of the other advantages is enough to offset the price of gas to such an extent that there is a saving with electricity.

• • •

Benefit by the above experience and investigate your needs for electric heat.

INFORMATIVE PAMPHLET ON INDUSTRIAL ELECTRIC HEATING ISSUED BY COMMONWEALTH EDISON COMPANY

Most central-station companies have not gone into the actual sale of electric heating equipment. Therefore they are entirely dependent upon the co-operation of the apparatus manufacturers for the selling of the heating engineers' recommendations to the prospects and for the actual installation of electric heating equipment in the customers' plants. This condition necessitates the closest possible contact between the service companies' heating engineers and the manufacturers

and their agreement on the requirements of the job. In some localities it has been difficult to get the whole-hearted assistance and co-operation of equipment manufacturers in the promotion of the electric heating load. At the start actual sales are few and hard to make and the manufacturers are reluctant to devote the time, effort and money to sales effort in territories where a great deal of missionary work is required and returns on the investment are slow coming in. It is distinctly up to the power companies to do the missionary work in their territories and to make it profitable for the manufacturers to put their efforts into the sale of equipment there.

The attitude for a heating engineer to assume toward various manufacturers of similar equipment is a delicate matter and considerable diplomacy must be displayed. By trying to give each manufacturer an equal opportunity to recommend or supply equipment for the same installation, the heating engineer can bring about a condition that entirely defeats all of his sales efforts. It has been found by bitter experience that whenever five or six manufacturers present proposals on the installation of certain heating equipment in a prospect's plant the prospect becomes so confused by conflicting claims and statements that he ultimately passes up all of the electrical equipment proposals. Every one loses, including the prospect, for the heating engineer would not have recommended electrical equipment had it not been to the customer's advantage.

This consideration has prompted some companies to adopt the policy of restricting their co-operation to a limited number of equipment manufacturers, recommending the installation of their furnaces wherever possible. This policy has resulted in some difficulties and considerable hard feeling among the manufacturers not favored, but the fact nevertheless remains that these service companies have been much more successful in increasing their electric heating load than some others by maintaining strict neutrality.

The policy of the power company going so far as to act as agent for the manufacturers and actually selling, installing and servicing equipment has been looked upon with favor in certain instances. This arrangement has the advantage of putting the entire situation under the control of the company's heating engineer and at the same time bringing a small profit on the sale. On the other hand, it has several disadvantages and is not favored by the manufacturers as a whole.

There has been very little actual experience with sales campaigns on industrial electric heating equipment, but this method of selling should be just as effective in promoting the use of electric heat as it has been in increasing the motor load, the lighting load and the appliance load. In the early stages of promotion, general educational campaigns are more necessary and will prove to be more effective than specialized campaigns designed to push a particular class of equipment. Later in the development sales effort may be concentrated on certain classes of industry, at which time the service company and the equipment manufacturers should co-operate in making as many installations as possible in these particular plants within a specified time. Certain inducements to the customers as regards cost of equipment, cost of installation and financing the investment will assist materially in making sales. Co-operation in the sale of commercial cooking equipment has resulted in splendid load increases in certain localities.

Campaigns on small standard units, such as glue pots, soldering pots, soldering irons, space heaters, etc., have educational value, as well as load-building value, in that the customer becomes somewhat familiar with and accustomed to the use of electric heat and is then more susceptible to sales effort on larger installations.

Publicity regarding existing local installations is very effective in bringing about additional similar installations, and at the same time it promotes general interest in electric heat. Such publicity usually has a good-will value in that the users of electric heat feel that the power company is giving them something more than kilowatt-hours.

Periodic distribution of pamphlets issued by the heating division and sent to potential users of electric heat has been found to be an effective means of publicity. Lectures and conferences on industrial heat applications held in co-operation with educational institutions always create interest and result in disseminating useful information. Such publicity must, of course, be governed by company policy and local conditions. Examples of this kind of information are illustrated here.

Service to the Users of Electric Heat

In the early stages of the promotion of electric heat in any territory a great deal of time and effort will have to be spent in keeping installations "sold." Service to the customer is even more essential in the new field of electric heat than it is in the fields of power and light. It is generally true that after an installation has been made the manufacturer of the equipment will devote very little attention to keeping it "sold" and it devolves upon the heating division to carry on.

Lack of familiarity with electric heating equipment and the application of electric heat in general often cause the users to complain about the efficiency of the equipment, operating conditions and costs, the amount of energy consumed or the rate. In all cases these complaints or inquiries must have immediate attention and the heating engineer must, by means of explanation, by analysis of the process and operating conditions or by test runs on equipment, be able to correct the trouble or misunderstanding that gives rise to the complaint and keep the user satisfied. It is of extreme importance to the further development of the heating load that the good will of existing users be fostered, for existing installations constitute the foundation on which additional business is to be built.

Excellent opportunities for additional load exist in those plants where there already are satisfactory installations. Engineering reports should be presented, showing the advantages of further electrification of other heating processes within the plant, and these reports should be vigorously followed up to secure additional electric installations. At all times the customer's best interest must be made the prime consideration in any recommendations that the heating division may make.

The heating division should be a bureau of information on the subject of electric heat, where the user and the prospective user of electric heat may come for complete, expert and unbiased answers to their industrial heating problems. Furthermore, the heating engineer should be in a position to give equipment manufacturers any information desired regarding the industries in his territory.

The relations of the gas and electric sales departments in combination companies are important. Usually the two departments are entirely separate and under different management, and consequently they are often competitors for industrial heating load. Just how vigorously the two departments should compete with each other and how they should co-operate is a problem that requires considerable thought, and the answer depends to some extent upon individual company policy. Vigorous competition has often placed the company in a peculiar position in the eyes of the prospective customers, and in some cases it has resulted in loss of business for both departments.

It is a good policy for representatives of the two departments to avoid verbal conflict in the presence of the prospective customer, but it has been found that it is generally beneficial to make each department stand on its own feet, get all the business it can, and where there is direct conflict, to allow the customer to make his own decision on the basis of all the facts in the case.

Mammoth Stage-Lighting Control for Roxy Theater

WHAT is reported to be the largest stage switchboard that has ever been constructed was installed on Jan. 6 in the stage switchboard room of the new Roxy Theater, New York City. More than 1,000 levers are on the board for controlling the lighting, which will demand about 1,500 kw. The combined control equipment weighs more than 50 tons, and the board is 22 ft. long. All of the large current breakers, which are remotely controlled, are in a fireproof inclosure in the basement.

The combined services of the New York Edison Company and the United Electric Light & Power Company are employed. Direct feeders have been installed between the generating stations and the theater to supplement the normal local supply through the city network.

The switchboard and control apparatus were manufactured and installed by the Hub Electric Company of Chicago.

Storage-Battery Locomotive for Yard Work

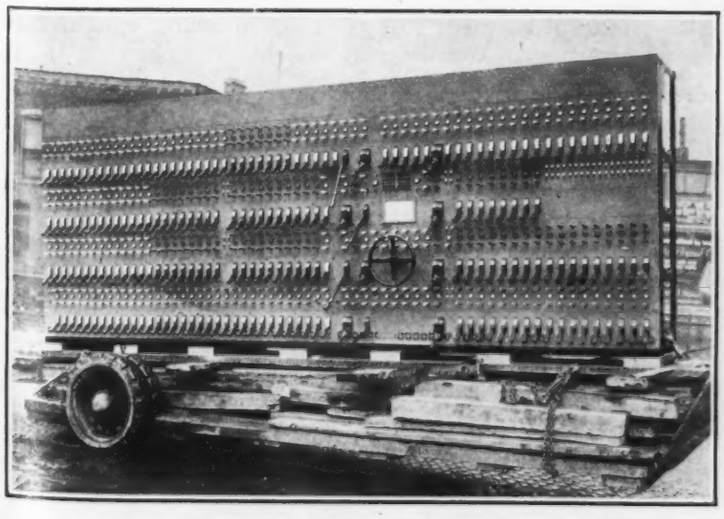
Results of Four-Day Test in Chicago Yard Service Are Presented, with Some Features of Equipment

A 120-TON, standard-gage, storage-battery locomotive, built by the General Electric Company and equipped with a 120-cell battery supplied by the Electric Storage Battery Company, is now on trial in Chicago. It was first used in the yards of the Chicago & Northwestern Railway for about a month and on Dec. 1, 1926, it was put in service in the Randolph yard of the Illinois Central Railway. The data here presented were accumulated during the test on the Chicago & North Western.

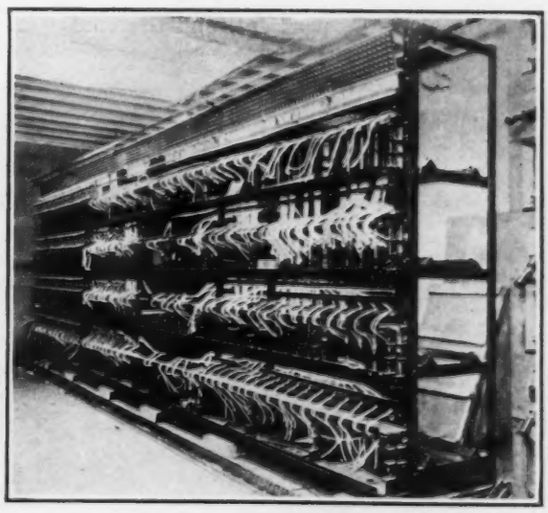
The locomotive is driven by four 200-hp., 225-volt motors connected to the wheels through a gear reduction of 66/16. The motors may be operated in multiple or series-parallel pairs, and the twenty-point control arrangement includes field taps. It is stated that the battery (2,700 amp.-hour capacity) is capable of supplying energy for the average eight-hour yard-switching service in Chicago on one discharge at an average speed of 7.33 miles per hour. If slowed down by coasting to the average speed of a steam locomotive doing the same work, the electric machine will work more than twelve hours in the average yard on one battery discharge.

RESULTS OF FOUR-DAY TEST OF STORAGE-BATTERY LOCOMOTIVE

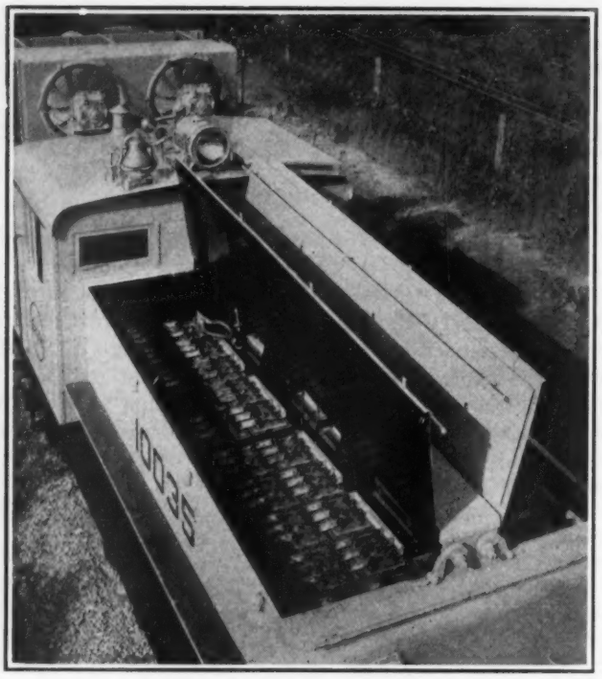
	Nov. 10	Nov. 11	Nov. 12	Nov. 13	Total
Hours worked	10	8	8	8	34
Total miles	41.3	41.6	44.3	26.0	153.2
Loaded miles	28.2	27.8	31.8	24.5	112.3
Light miles	13.1	13.8	12.5	1.5	40.9
Kilowatt-hours discharged	431	398	500	383	1,712
Ton-miles, excluding engine	4,265	3,711	4,033	4,854	16,863
Gross ton-miles, including engine	9,138	8,620	9,270	7,922	34,950
Trailing ton-miles per loaded engine-mile	151	133	127	198	150
Total ton-miles per kilowatt-hour	20.2	21.64	18.54	20.68	20.42
Watt-hours per gross ton-mile	49.5	46.2	53.9	48.3	49.0
Watt-hours per trailing ton-mile	101.0	107.2	124.0	78.9	101.5
Kilowatt-hours per hour	43.1	49.8	62.5	47.9	50.3



SECTION OF THEATER-LIGHTING CONTROL IN TRANSPORT



BACK-OF-BOARD WIRING



FORWARD BATTERY COMPARTMENT IN CHICAGO & NORTHWESTERN YARD LOCOMOTIVE

The principal virtue of the storage-battery over the steam locomotive, aside from smoke abatement, is the greatly increased acceleration obtained.

The locomotive carries a "kicker" power source in the form of a 200-hp. gasoline-engine driving a 135-kw. generator, which may be used for boosting the battery while the machine is at work and for driving on long runs between charging points. For yards where outside energy supply is available for third rail or overhead it is intended to substitute a high-speed motor-generator set for the engine.

The input energy as shown in the accompanying table was supplied from the Commonwealth Edison system and was taken between, approximately, the hours of midnight and 6 in the morning. No figures on demand are available, but an average demand over the charging period would probably lie between 60 and 100 kw., with a short-time maximum of 250 kw. at the beginning of a full charge. The difference between the input and the discharge figures is explained by the battery efficiency, which is about 88 per cent, and the energy contributions of the gasoline engine.

STORAGE-BATTERY INPUT AND DISCHARGE WHILE LOCOMOTIVE WAS IN YARD SERVICE

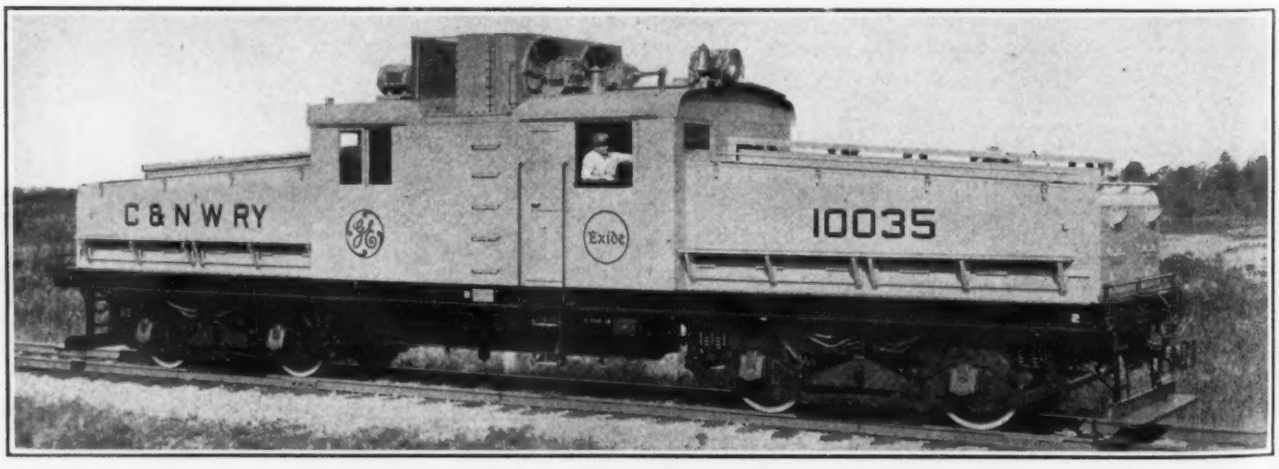
Date Oct.	Miles	Discharge, Kw.-Hr.	Input, Kw.-Hr.	Date Nov.	Miles	Discharge, Kw.-Hr.	Input, Kw.-Hr.
18	34	425	540	4	38	543	548
19	29	785	448	5	34	757	510
20	27	622	624	6	37	434	612
21	38	477	702	7	6	56	361
22	28	500	614	8	38	904	000
23	32†	806	482	9	31	753	466
24	6	000	653	10	39	523	593
25	9	279	000	11	65	816	252
26	....	310	000	12	59	582	439
27	Out	672	431	13	24	444	551
28	16	65	671	14	00	00	361
29	29	341	00	15	33	356	00
30	34	632	430	16	25	206	316
Nov.							
1	22	340	619	17	16	90	181
2	27	525	311	18	31	416	415
3	29	665	472				

Total input (31 days), 12,602 kw.-hr.
Total discharge (31 days), *14,324 kw.-hr.
Total mileage, 830+.
Average input per day, 406.51 kw.-hr.
Average discharge per day, 462.06 kw-hr.
Average mileage per day, 27+.

*Difference caused by "kicker" and battery efficiency. †Pulled.

It is calculated that this locomotive, with a trailing load of 213 tons and moving at twenty miles per hour, will have a power cost of seven and one-half cents per mile, all motor energy being supplied by the battery, which is charged at an off-peak rate of one cent per kilowatt-hour. This is equivalent to 0.0225 cent per ton-mile. It is not possible to present the energy cost for yard work on a ton-mile basis, on account of the character of the work. However, from the total mileage figure in the table, an approximate cost of nineteen cents per mile is shown for yard work. For convenience in determining the above costs the figure of one cent per kilowatt-hour is used with a theoretical battery efficiency of 88 per cent.

Tests were conducted by officials of the Chicago & Northwestern Railway Company on the storage-battery locomotive while it was operating in the Chicago passenger terminal. The locomotive was used for shifting and spotting mail and express cars in and about the terminal, and the results of a four-day test showed that, on the average, 50.3 kw.-hr. per hour is required for this kind of service. Based on a 620 kw.-hr. battery capacity, the locomotive will do this work for twelve hours on one discharge, without the use of the gasoline-engine "kicker," at a total cost of $8 for power, or 67 cents per hour. This is based on a unit cost of one cent per kilowatt-hour at the charging plug.



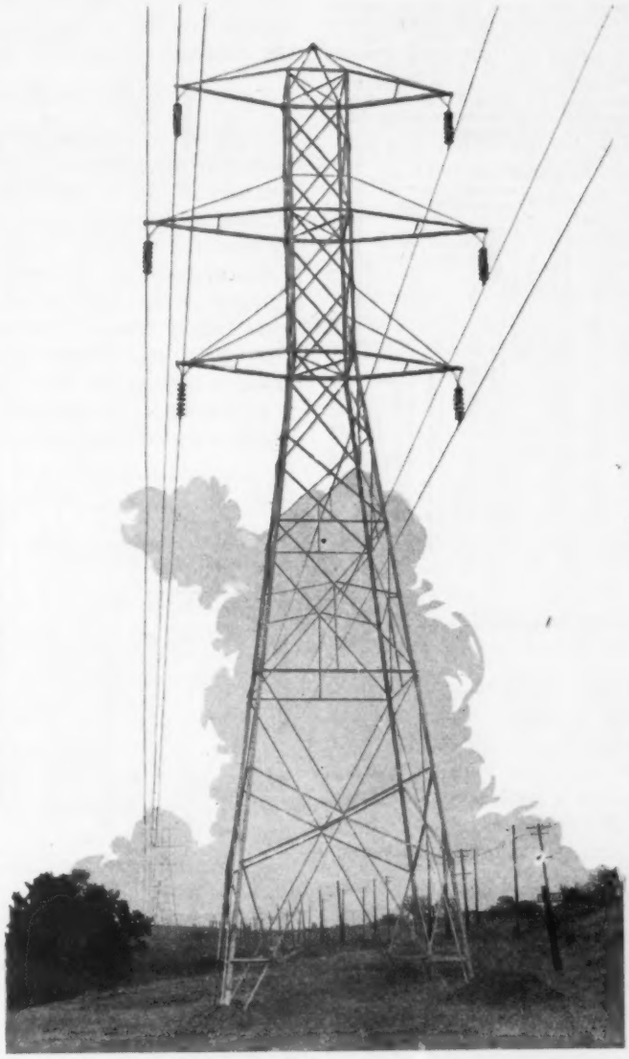
120-TON STORAGE-BATTERY LOCOMOTIVE FOR CHICAGO YARD DUTY

Transmission and Service Reliability

Latter Not a Direct Function of Transmission Reliability if More than One Feed and Proper Relaying Are Provided—Analysis of Performance of Five Sections of a Transmission Line

RELIABILITY of service from transmitted power is not a direct function of transmission reliability unless that service is rendered by a single line. With service available from two or more lines or directions, the service reliability may actually be 100 per cent, even if there are interruptions on both lines, provided they do not occur simultaneously and the lines are properly relayed. In fact, the transmission interruptions on the two or more individual supplies may be relatively numerous and prolonged and service reliability can still be perfect. This is proved by actual records from one system for the year 1925, as shown later. Naturally, however, the prospects of service interruption are greater the more frequent and prolonged the interruptions on transmission lines. For this reason it is interesting to analyze some performance records.

To get a true picture of transmission-line reliability, lines having different voltage, construction, relay protection, degrees of interconnection and exposure to climatic conditions should be considered. However, only one set of conditions, which can be duplicated in many places in this country, will be considered now.



HOWEVER HASTILY ERECTED TO MEET EMERGENCIES, TRANSMISSION LINES MUST RENDER RELIABLE SERVICE

The layout of the lines studied is shown in Fig. 1. Being erected hurriedly to permit exchange of power between *A* and *B*, the lines could not be given the attention in design, construction and equipment which they might have been given had their need not been so urgent. During the period for which records are analyzed the voltage regulation of the lines alone limited them to 25,000 kva. apiece, but only one bank of 25,000-kva. transformers was installed at each end. This rating, which has been doubled since the study, limited the synchronizing power of the lines during system disturbances and partly accounts for some of the interruptions.

Besides being connected as described, they are interconnected through *A* and *B* with a transmission network measuring roughly 150 miles north and south and 135 miles east and west, including foreign-line interconnections. This gives some measure of the exposure to climatic conditions and reflections of system disturbances. Since most storms in this region come from the westerly sector of the compass, it may be interesting to observe that the lines extend northeast and southwest and hence may be subject to several storm paths.

STORMS UNUSUALLY SEVERE

Lightning was very severe in July and August, 1925—the period studied—being worse than for any previous period in the history of the operating company. The right-of-way, which has considerable effect on the direct exposure of the line, is along highways (60 per cent along a river valley) and crosses one river. The right-of-way is hilly and wooded, but the trees are well trimmed back from the line. Lightning arresters are installed on the incoming lines at each station. No ground wires were installed until August, 1925, after the lightning season was over.

The relay protection has been gradually changed. Up to September, 1925, balanced, overload and ground protection was used at *A;* differential, reverse power and overload at *C;* and balanced, overload and differential protection at *B*. Then the protection was changed to balanced, directional, overload and ground relays at *A;* directional, overload and ground at *D;* and balanced, directional and overload differential and ground at *C*. The protection at *B* was maintained. Changes have been made since then, but they do not affect the results presented here and are consequently passed over.

It is recognized that experience obtained on one sys-

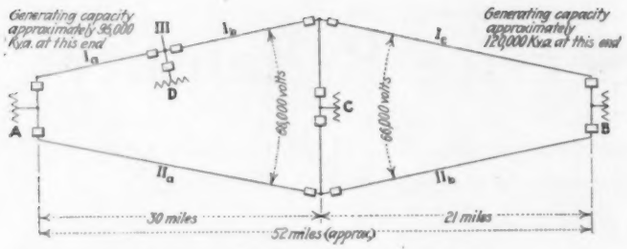


FIG. 1—LAYOUT OF LINES STUDIED

Except for a 1,300-ft. river crossing, the lines are supported on wood poles ranging from 45 to 50 ft. in height, with 300-ft. spans (average). Steel-reinforced aluminum-conductor cable (equivalent to 300,000 circ.mil copper) is spaced in right-angle triangle formation (8 ft. horizontal, 7 ft. vertical). From *A* to *C* the suspension insulators consist of four units with a dry flash-over of 88,500 volts per unit and wet flash-over of 56,000 volts. From *C* to *D* five units of a different type are used in suspension, having values of 75,500 and 45,000 volts per unit respectively.

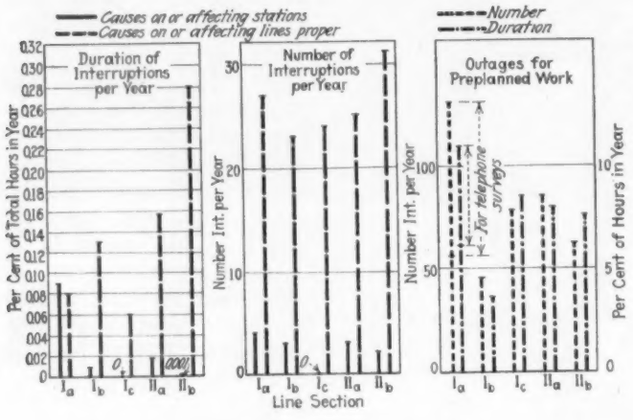

Causes on or affecting stations
Causes on or affecting lines proper
Number
Duration
Duration of Interruptions per Year
Per Cent of Total Hours in Year
Number of Interruptions per Year
Number Int. per Year
Outages for Preplanned Work
For telephone surveys
Number Int. per Year
Per Cent of Hours in Year
Line Section

FIG. 2—RÉSUMÉ OF OUTAGES

tem is not applicable to another. Furthermore, it is very questionable whether any general conclusions can be drawn from specific experiences. However, the data are presented graphically to indicate what a person can do in a short time to analyze a year's performance. Analysis could undoubtedly be greatly expedited if the data were compiled with the purpose definitely in view.

BASIS OF ANALYSIS

For lack of finer classifications of interruption records, they were divided into (1) preplanned work, including maintenance or repair of lines and telephone surveys; (2) causes in or affecting stations and equipment connected to lines and including station trouble, faulty relay operation and errors in operation; (3) causes on or affecting lines proper, including storms, swinging of lines, line trouble, poles down, burned pole tops, system trouble, swinging of load and ordered outage for the latter.

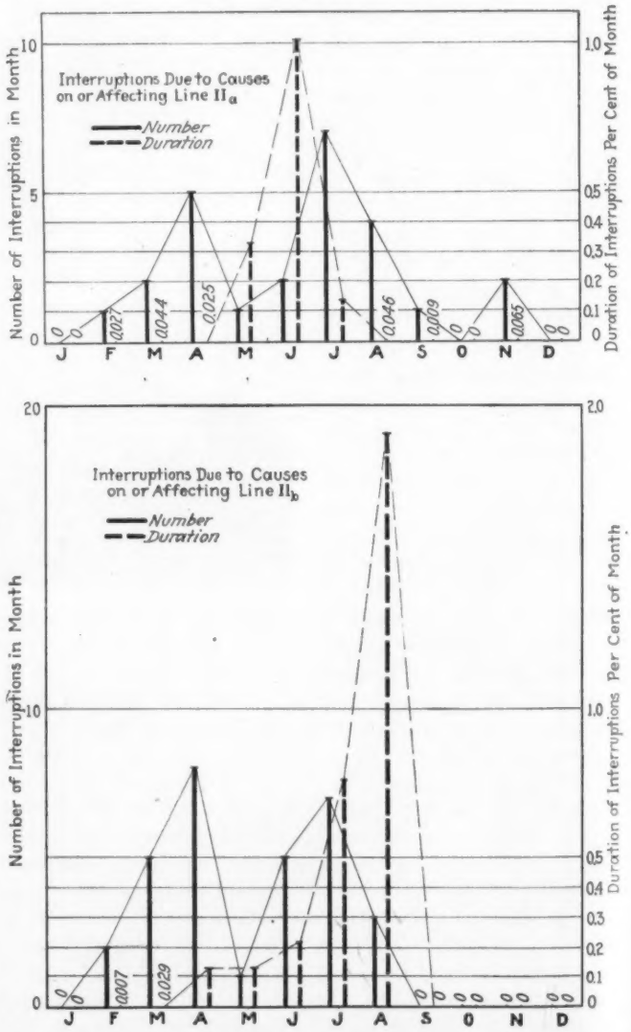
From the master chart, Fig. 2, it will be observed that the number of preplanned outages ranged from 45 to 130 per section per year. If the outages for telephone surveys were omitted, the average number of interruptions per section per year for preplanned work would be about 65. The duration of these outages, with the same exception, was about 6.9 per cent of the year per section. This indicates that, unless a line is maintained while "hot," provision must be made for preventing interruptions to service while lines are out for preplanned work. Since such outages are preplanned, they can usually be made so they will not inconvenience customers greatly.

Transmission interruptions due to causes in or affecting stations and equipment immediately attached to the lines considered were relatively insignificant compared with those due to causes on or affecting the lines proper and preplanned outages. The number of interruptions per year per section due to the lines proper ranged from 23 to 31 and averaged 26 per year, or only 40 per cent of the preplanned outages. Based on duration of outage, the interruptions due to the lines proper were even less, ranging from 0.06 per cent to 0.28 per cent of the year per section and averaging 0.14 per cent If line IIb had given experience similar to the others, the average would have been nearer 0.11 per cent.

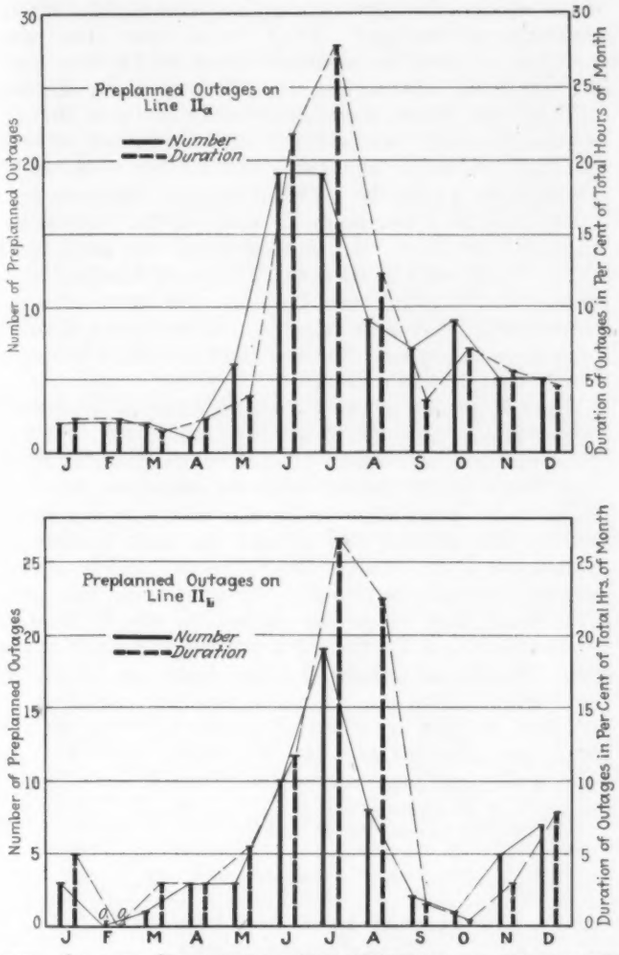
LIGHTNING MONTHS CHIEF HAZARD

Time of occurrence of interruptions due to the lines proper is interesting. This is shown by months for two sections of one of the lines (II) in Figs. 3 and 4. The storms in June, July and August directly or indirectly account for the bulk of the interruptions, although even February and April were attended by relatively large outages on two sections of line I. January and October were totally free of interruptions, November, December, February and March also being notable for their relative absence of interruptions.

If the log of interruptions on which this analysis was based were carefully studied, it would be observed that



FIGS. 3A AND 3B—NUMBER AND DURATION OF TRANSMISSION INTERRUPTIONS AFFECTING SECTIONS OF LINE II


Preplanned Outages on Line II_a
Number
Duration
Number of Preplanned Outages
Duration of Outages in Per Cent of Total Hours of Month
J F M A M J J A S O N D
Preplanned Outages on Line II_b
Number
Duration
Number of Preplanned Outages
Duration of Outages in Per Cent of Total Hrs. of Month
J F M A M J J A S O N D

FIGS. 4A AND 4B—NUMBER AND DURATION OF PREPLANNED OUTAGES ON SECTIONS OF LINE II

some of the interruptions affected more than one section of line simultaneously or nearly so. This proves that a transmission line suffers not alone from causes on or affecting itself alone but from reflected disturbances on the interconnected system unless relays are applied properly and operate perfectly. The solution of this problem is yet in its evolutionary stage with most companies so far as networks are concerned.

INTERRUPTIONS CHIEFLY AFTER NOON

The time of the day that disturbances occur appears to have no definite boundaries. It is interesting to note, however, that most of those studied occurred after noon and before midnight.

Although preplanned outages are primarily for regular inspection and maintenance work, some disturbances leave in their wake conditions that have to be rectified immediately. Hence the time at which preplanned outages occur cannot fall solely within those months or hours when interruption hazards are least. Other conditions permitting preplanned work might be done in January, October, November and December, when interruptions are absent or almost negligible. If equal experience had been had on both lines I and II, even February and March could be included as good months for preplanned outages on this system.

100 PER CENT SERVICE RELIABILITY FOR ELEVEN MONTHS

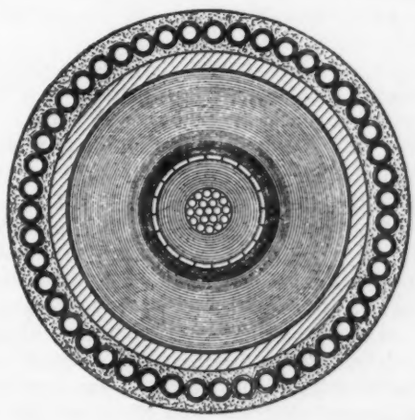
Despite the number and duration of transmission interruptions indicated, a record of service was obtained at *C* (fed entirely by transmitted power), which is suggestive of what can be done to safeguard service from transmitted power in the face of adversity. In every month except July, or 92 per cent of the year, service was 100 per cent reliable at *C*. In July, the worst lightning month and period of transmission interruptions, the service interruptions at *C* numbered only four and totaled five minutes.

Cable for 110 Kv. Displayed at Düsseldorf

Three Concentric Layers of Various Thicknesses Constitute Impregnated Paper Insulation—Concentric Conductors Reduce Potential Stress Around Central Conductor

A NEW cable for 110,000-volt transmission was displayed at the recent industrial exhibition in Düsseldorf by the Felten & Guilleaume Karlswerk Gesellschaft of Mulheim, Cologne, Germany, for the Rhenish Westphalian Electricity Supply Company. A section of the new cable is illustrated herewith. Around a centrally arranged copper cable is a layer of paper insulation, over which is laid a plaited layer of flat sectional copper wires. The current passes through both the central cable and the concentric ring. The total copper cross-sectional area is only 95 sq.mm., but the conductor has an artificially enlarged diameter of 0.88 in., so that the potential gradient in the innermost insulation is relatively low.

With the object of providing great strength against puncturing, the insulation is laid up in three concentric layers of varying thicknesses of paper, which are saturated with an oil composition. The innermost layer is the thickest and the outer layer the thinnest. The diameter of the cable under the lead covering is 2.38 in.



SECTION OF GERMAN CABLE WHICH WAS RECENTLY DISPLAYED FOR 110,000-VOLT TRANSMISSION

The cable is armored with round steel wires of special composition separated by 33 per cent of their thickness. The transmission losses in the armoring of this type of cable are reported to amount to but 5 per cent and in the lead covering to 15 per cent of the losses in the cable conductor.

The external diameter of the cable is 80 mm. (about 3.14 in.). End bells are provided for overhead connection of the cable with 110-kv. lines.

Letters from Our Readers

Hindrances to Circuit-Breaker Development

To the Editor of the ELECTRICAL WORLD:

Your editorial in the issue of Jan. 22 entitled "Hindrances to Circuit-Breaker Development" is certainly timely, and it may be hoped that your remarks will initiate a discussion of the question which will gradually break the mysterious cloud surrounding it. I am sure, therefore, that you will permit me to express my opinion freely, even though it may in some respects be diametrically opposite to your own.

First of all, your editorial is based altogether on the manufacturer's viewpoint, if, in the existing confusion, it is at all proper to speak of a viewpoint. The manufacturers are spending enormous amounts of money on research and development, to be sure, but who finally pays the bill? Obviously, the public utility that buys the breaker. Why should breakers be so expensive if it were not for the fact that development charges have to be paid? Because a breaker, aside from the development charge, is nothing more than so many pounds of manufactured metal and insulating material which costs so much a pound.

What has been accomplished through all these years of research and millions upon millions of expenditures? Some one once found that oil is a good medium for switching—a new and revolutionary idea then and very useful ever since. Then some one very ingeniously invented the principle of the explosion chamber, no doubt a radically new idea and very useful in some cases. Then some one had the idea of the multibreak, an imitation of the multibreak fuse, but likewise a very useful appliance.

What else? Nothing. Make the tanks larger and of heavier steel, use more oil, make heavier contacts and heavier springs, and don't forget the old bell crank. It would appear that switch-mechanism designers never heard of any other kinematic device except the bell crank.

Rupturing capacity guarantees were always a joke. No manufacturer was ever ready to submit the figures upon which his breaker rating was based. When a transformer or a motor or a turbine is purchased, there is no mystery about the guarantees; the constants and calculations upon which they are based are available. Not so in the field of breakers. The manufacturer is always at an advantage, for two principal reasons. When a motor heats above the guarantee the fact can be ascertained by a child, but when a breaker blows up no power on earth can determine what really caused the accident. It may have been bad oil; it may have been poor adjustment; it may have been anything. The second advantage that the manufacturer has is that a certain time interval—0.2 second, 0.3 second, etc.—is assumed from the beginning of the short to the time of the opening, based mostly on shop or laboratory tests, and this time interval is probably always longer in actual "shorts" on a property, because old Mr. Bell Crank and the rest of the family are no doubt somewhat rheumatic after a switch has been in operation a certain time.

Large public utilities did make a great many tests recently at their own expense—the only tests of any value so far. But why did these public utilities undertake these tests? Why did they select breakers instead of any of the other thousands of articles which they are regularly purchasing? They found that they were spending millions on switches about which they could get very little information, and after spending all these millions they found themselves losing fortunes through service interruptions without any possibility of ever collecting anything from the manufacturer on a rupturing-capacity guarantee. Therefore they made up their minds that they are going to find out for themselves. All credit to them. If they keep up the good work, they will find out a great deal. They have already found enough to make the manufacturers refuse to give any guarantee on rupturing capacity. Who ever paid money for a piece of property because the man who sold it "believed" that he had a deed?

What is needed in the switching game is not merely bigger tanks, more oil, heavier contacts, etc., but new ideas, radically new ideas. Not development, but invention. What is the matter with the American inventive genius? In what other fields are men working in expensive laboratories, day in and day out, having unlimited research means at their disposal, and producing nothing? The manufacturers have at their disposal a great many men of genius—scientists who continually startle the world by their discoveries and their inventions. Why don't they let them loose on switch investigation? The buying public has lost confidence in switches, it is up to the manufacturer to bring out new ideas, new theories and new principles, new mediums, besides oil, and thus regain their confidence. This is the basis of all sound business.

M. M. SAMUELS.
J. G. White Engineering Corporation,
New York City.

Division of Load in Three-Phase Transformer Banks

To the Editor of the ELECTRICAL WORLD:

Referring to H. S. Lane's letter in your issue of Jan. 8, it is not necessary to use a method of trial for the case described in the last paragraph. With a star-delta connection of transformers and floating primary neutrals, the vector equations fixing the transformer currents are as Mr. Lane has given them:

$$\begin{aligned} CA - AB &= AA_1 \\ AB - BC &= BB_1 \\ BC - CA &= CC_1 \\ AB + BC + CA &= 0 \end{aligned}$$

These equations may be readily solved analytically by means of complex numbers or AA_1, BB_1 and CC_1 can be resolved graphically. The construction in this latter case is as follows: Lay off AA_1, BB_1 and CC_1 so as to form a closed triangle with arrows pointing around it in a counter-clockwise direction. This can always be done because the sum of these three currents is zero. From each vertex of the triangle formed draw a line to the middle of the opposite side. These lines will meet in a common point. The three lines joining this common point and the vertices of the triangle will represent the transformer currents in magnitude and direction if the arrowheads are applied pointing to the vertices. AB will be the line between AA_1 and BB_1, BC that between BB_1 and CC_1, and CA that between AA_1 and CC_1. This graphic resolution is simple and rapid in execution and saves the labor of a solution by trial.

CHARLES E. DANIELS,
Assistant Electrical Engineer.
Scranton Electric Company,
Scranton, Pa.

Would Industry Like This Done?

To the Editor of the ELECTRICAL WORLD:

Since interconnected power systems have become so important in the development of the country and since there is increasing demand for information concerning the route of interconnected power systems, is it not about time for the publishers of maps for general use to include power lines on their individual state maps? Of course, the mapmakers and publishers will not include power lines of their own initiative, because of the additional cost, but I think the electrical industry might work up sentiment for the inclusion of power lines on maps for general use.

I am now negotiating with one publisher for the inclusion of our system on the map he issues. If we could get one or two makers started, the others would be likely to fall in line. The inclusion of power lines on maps would be helpful to the power companies, as well as to communities, since it would serve to create demand in communities not yet supplied with service by a system of interconnected power stations.

Arkansas Power & Light Company, Pine Bluff, Ark. A. G. WHIDDEN, Advertising Manager.

Are Conventions Worth While?

To the Editor of the ELECTRICAL WORLD:

To leave one's business for a week and to spend a couple of hundred dollars, more or less, journeying to a distant city to attend a gathering of men engaged in the same line of business as one's self demands some compensating advantages. Some more powerful reason than "the good of the industry" must exist. Eliminating all altruistic considerations, we come down to the real question, "What good shall I get out of it?"

There are so many demands made on our time and purse that we would soon have no business at all, and no balance in the bank, if we did not safeguard our minutes and our money. Conventions are strictly business affairs, and whether one attends or not should be decided on business grounds. But is it possible to bring together in daily conference for four or five days several hundred men in the same industry as one's self and get no benefit from mingling with them? Of course, the best of the talks will be printed in the trade papers, but what we cannot get at home is the mental stimulus, as well as the practical suggestions for increasing one's business and one's profits, that one gets at a convention. The benefits are obtained not in the convention hall itself but in conversation at the dinner table, in the hotel lobby or wherever we meet other men. No one will deny that he would profit immensely by the opportunity to visit hundreds of factories and companies engaged in the same business as himself. We cannot possibly acquire in our own town and in a single lifetime the experience of hundreds of men in all parts of the United States.

At the convention we meet these men—manufacturers and operators—we see under one roof the latest products of a hundred factories, we chat with men who in a city far removed from our own are conducting a business similar to ours and who, because their customers can never be ours, are willing to tell us of methods that they have found to be successful in conducting their business. Each day we pick up new ideas, and we return home with a clearer conception of the things we must do to increase our business and with a keener desire to do them. Compare the man who has just returned from the convention of his industry with the man who stays at home. Which man would you prefer to deal with—the man who is as well posted as though he had spent six months visiting factories and other companies' systems, or the stay-at-home whose knowledge is limited to what he learns from the salesmen who occasionally drop in on him and to information derived from manufacturers' catalogs?

Cleveland, Ohio. ROGER A. LEA.

Declares Comparison of Meters Works Injustice

To the Editor of the ELECTRICAL WORLD:

With reference to the article appearing in your issue of Jan. 8 (page 101) entitled "Foreign and Domestic Meters Compared," I wish to enter objection to the general tone and effect of the article as misleading (although doubtless unintentionally so) as to the facts concerning the relative merits of American-made and foreign-made meters.

In the first instance, the makes of the foreign-made meters and of the domestic meters which were tested are not stated, nor are the conditions of the procedure followed during the various tests stated. The natural net result of the publication of these blind and unnamed tests is that, in what is supposed to be an absolutely fair and open market, any foreign meter, including even the best, is undeservedly injured and handicapped by anonymous reports on what may be some of the poorest makes of foreign meters.

The summary, apparently editorial, on page 103, in the paragraph beginning "In general it was found that the high-grade European meters, etc.," raises the implication very clearly that *all* European meters were inferior to American meters in the main and essential features of continuous performance and in mechanical construction. Such a generalization must work undeserved harm and hardship to even the best European meters selling in this market. If you will permit me to close with a personal word as the American distributor of meters made by Landis & Gyr of Zug, Switzerland, I can guarantee all performances of our meters equal to those of any American-made meters upon any and all of the essential points of initial or long-continued service.

New York City. HERBERT NEHLS.

[Note.—The article referred to by Mr. Nehls was an abstract of a report by the meter committee of the N.E.L.A. (Publication No. 267-7). This report was a reprint of a report of the committee on metering and service methods of the Association of Edison Illuminating Companies for 1924-1925. The tests were made by the Electrical Testing Laboratories on European meters of the following makes as given in Table II of the N.E.L.A. report:

SUMMARY OF EUROPEAN METER TESTS

Maker	Country	Type	Volts	Amp.	Cycles	No. Tested
Bergmann Elektricitäts.....	Germany	NE-1	110	10	60	1
Werke Aktiengesellschaft ...	Germany	W	110	10	60	1
Instrumenti di Misura, C.G.S.	Italy	K-I-B	110	5	60	10
Ferranti, Ltd	England	FCb	110	5	60	5
Ferranti, Ltd	England	FDb	110	5	60	5
Landis & Gyr	Switzerland	CBo	110	5	60	10
Sangamo Electric Co. of Canada	Canada	S-2	110	5	60	10
Siemens-Schuckert	Germany ..	G5a	120	5	D.C.	5

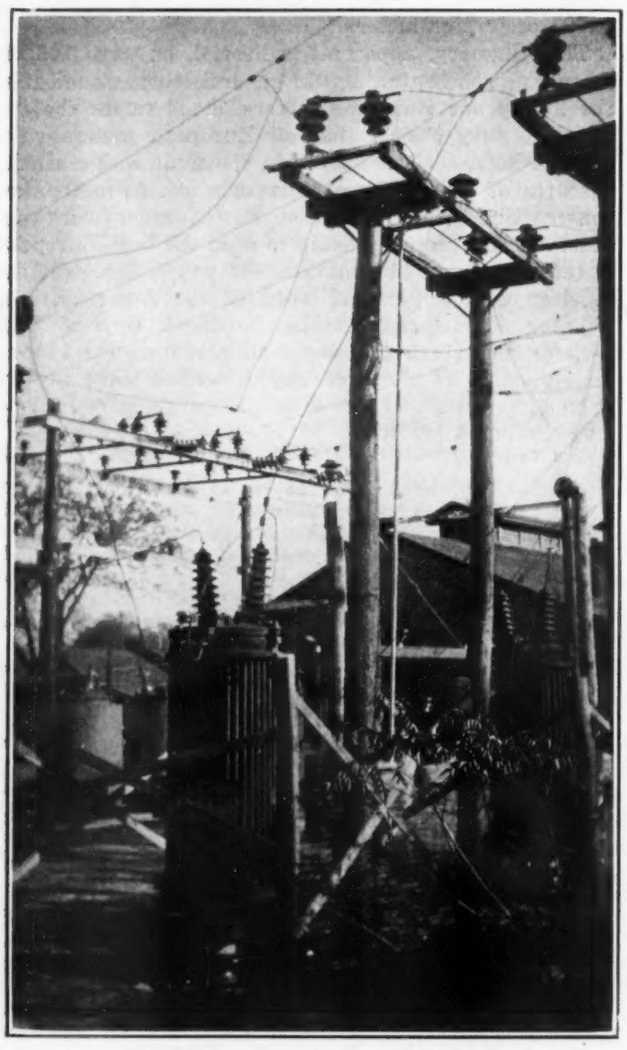
The data are thus two or three years old, and improved designs of meters have been produced by both American and European manufacturers since the tests were made. The interpretation of certain statements in the N.E.L.A. report is a matter of opinion, but the abstract published was made directly from the report.—EDITOR.]

Central Station and Industrial Practice

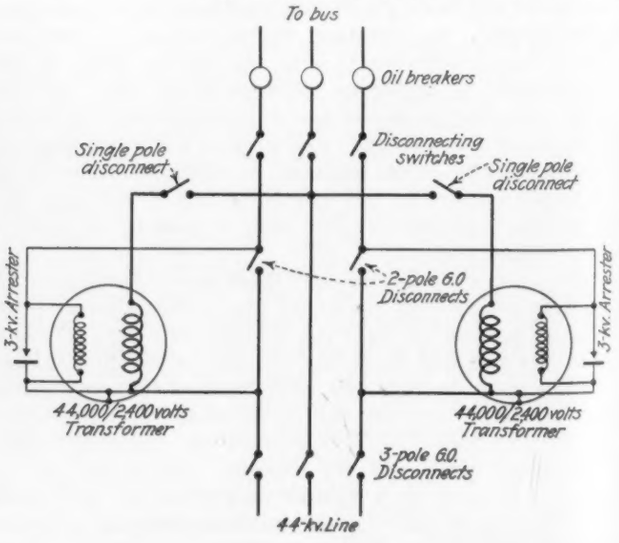
Booster Connection for 44-Kv. Substation

IN AN emergency situation to boost the voltage at one of its 44-kv. substations before voltage conditions could be permanently improved, the engineering department of the Alabama Power Company installed two transformers as shown in the accompanying illustrations. This arrangement boosted the voltage 1,600 volts.

The transformers used were rated at 100 kva., 22,000-44,000/600-2,400 volts single-phase and were inserted in the incoming line with disconnecting switches so that they could be shunted out at periods of light load. To protect these transformers from overvoltage on the 2,400-volt winding, one side of the 44,000-volt and 2,400-volt windings and the transformer case were tied together as shown and each transformer set on 44,000-volt insulators. A 3,000-volt arrester was placed across each 2,400-volt winding for further protection.



PHYSICAL ARRANGEMENT OF TRANSFORMERS TO GIVE 1,600-VOLT BOOST ON 44-KV. CIRCUIT AND SCHEMATIC DIAGRAM OF CONNECTIONS AND SWITCHING



Induction-Relay Maintenance Important

BY N. P. CARLSEN, JR.
Assistant to Engineer of Operation, Pacific Gas & Electric Company, San Francisco, Cal.

SO MUCH dependence is placed on relays and their proper functioning in large power networks that it has become of the greatest importance properly to inspect, clean and test relays periodically if a high percentage of correct operations is to be expected. Dust has been a source of trouble, although modern induction-type relays are supposed to be dustproof. It has been found that sufficient dust will accumulate on the rotating disks in the course of a year to give considerable trouble. Periodical inspection and cleaning is the only way to overcome trouble of this nature. It has also been found that contacts will burn and eventually fail to make contact, particularly on systems using low-voltage trip circuits. Here again inspection is important.

As regards dependability, there is little cause for trouble from current circuits supplied by core-type current transformers, but when bushing-type current transformers are used, it has been found good practice to test relays at least once a year. This is done by the over-all test method described by the author in the ELECTRICAL WORLD for Nov. 22, 1924, page 1108. Trouble with bushing-type current transformers has been more prevalent with the earlier types, where it would seem that little attention was paid to insulation of the current coil or the receptacle holding the coil. The result is that the insulation wears off and the turns of the coil become grounded or short circuited, resulting in a ratio change and generally in the non-operation of the relay connected to the coil. The most satisfactory means of locating and remedying trouble of this nature is by an over-all test of the current

transformer and relay, at the same time checking current ratios.

Another source of trouble is grounds or short circuits within the relay itself. These can be detected by secondary tests and are readily remedied by removing the current element of the relay and reinsulating the parts affected. Oftentimes a relay will be charged with non-operation when the cause of the trouble is in an auxiliary in the trip circuit. The best way, in the writer's experience, to locate such trouble is by the over-all test mentioned. Commonly the cause of trouble in the auxiliaries is dirt or corrosion of the contacts of the contactor, the relay or the pallet switches.

It is not unusual to find trouble in a relay system caused by grounds in the current leads, particularly if lead-covered cable is not used. Generally such trouble will be found in the conduit between switch tanks, especially if oil from switch tanks has found its way into the conduit. Oil will cause the rubber insulation to deteriorate, permitting short circuits and grounds. In these cases also the quickest way to find the trouble is by an over-all test.

"Careful Club" Effective in Reducing Accidents

By R. G. Boyles
Superintendent Distribution Southern California Edison Company, Los Angeles, Cal.

ACCIDENT-PREVENTION work among the employees of the Southern California Edison Company is a very vital issue to the company from an economic standpoint. This statement may sound rather mercenary and requires some explanation. If an employee of any public utility in the State of California is injured in the discharge of his regular duties to such an extent that he is not able to report for work, he is paid 65 per cent of his regular salary, beginning with the eighth day of his enforced idleness. This means that the company is paying 65 per cent of the employees' salary, for which it receives no return, and the employee who is off duty on account of his injury is losing 35 per cent of his regular salary in addition to one week's time for which he receives no compensation.

Quite often this is a serious situation for the employee. In addition to the loss of his income, he suffers the physical and mental discomfort that usually accompany such cases.

"NO-ACCIDENT" PLAQUE CARRIED ON LINE TRUCKS

The plaque, which is shown alone at the left, is awarded after six months of no accidents and is retained so long as no accidents occur.

AVOIDABLE ACCIDENT FORFEITS RIGHT TO WEAR THIS BUTTON FOR THREE MONTHS

Looking at the matter from this standpoint, both parties concerned have everything to gain and nothing to lose by preventing accidents. The position of the employee is always the more difficult of the two, and for this reason the Southern California Edison Company has undertaken the formation of "Careful Clubs" among the field forces in an endeavor to gain the help and co-operation of the men in the field in eliminating all accidents possible. This particular line of work was undertaken about one year ago and is producing very gratifying results.

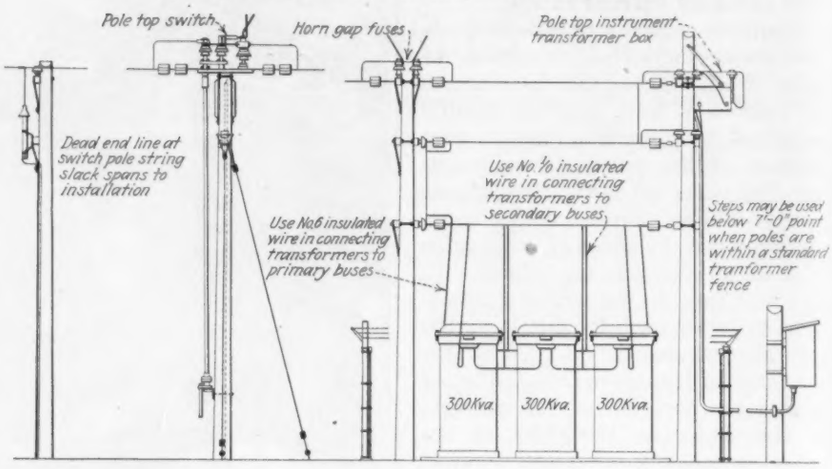
"Careful Clubs" have been organized in each of the company's 30 districts. Membership of the clubs includes all gang foremen in the district, with the district superintendent as chairman. The size of the club varies considerably, there being from five to twenty members in each, depending on the size of the district and the amount of work under way. To facilitate distribution work the system has been divided into three divisions, with a division superintendent in charge of each, giving approximately ten districts in each division. The same organization is used in handling the accident prevention work, so that the district superintendents of each division comprise the division "Careful Club," with the division superintendent as chairman. In this way the general office is kept informed of the activities of each district club and keeps a file of the minutes.

Districts hold meetings once a month, with a secretary in attendance to record discussions. Discussions cover any accidents that may have occurred during the current month and suggestions for better and safer methods of handling the work in the distribution department. First-aid demonstrations are held and practice in artificial respiration is encouraged. Occasionally all the employees in the district are invited to attend the meetings and are given the benefit of the instructions. Outside speakers are sometimes invited to address the club, and this has proved to be very helpful in keeping up interest and has been of value in the instruction of the men.

To create a keener interest in safety measures among district employees the company has provided a small button to be worn by each member of the "Careful Club" committee in the district. When the district "Careful Club" was organized, each member was given his button and the rules governing the wearing of it were carefully explained. The foreman of each crew, being a member of the club, was made responsible for any accidents that might occur among the men who work with him. If an avoidable accident occurs that causes loss of time to anyone or damage to any property, the foreman forfeits his button until he has passed three months without an accident. Any crew having no accident for a period of six months is given a plaque to be placed and retained on its truck so long as no accident occurs. If one year elapses without an accident an additional plaque to supplement the former is placed on the truck.

The organization outlined has created a keen interest among the men in the field and is showing results in that the number of accidents is gradually decreasing. The company realizes, however, that some accidents will always occur, and for this reason every man in the gang should be prepared to render emergency service. The company now has men in training who will be prepared to carry this instruction still farther so that every foreman will be able to care intelligently for any one injured until medical aid can be secured. Instructors will meet with each club once a month and assist by lecture and demonstration. The field men have been working on their own resources to a large extent previously.

6,900-Volt Transformer Installation


Pole top switch
Horn gap fuses
Pole top instrument transformer box
Dead end line at switch pole string slack spans to installation
Use No 6 insulated wire in connecting transformers to secondary buses
Use No 6 insulated wire in connecting transformers to primary buses
Steps may be used below 7'-0" point when poles are within a standard tranformer fence
300Kva.
300Kva.
300Kva.

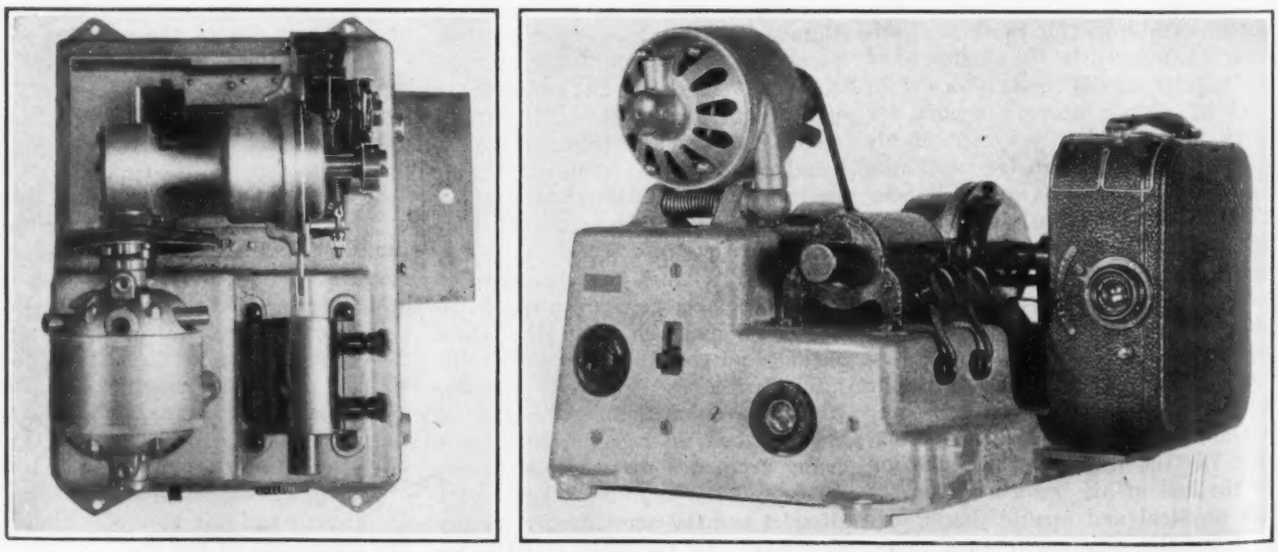
THE West Penn Power Company has recently standardized the accompanying general type of construction for installations involving 6,900-volt transformers of the larger sizes. This illustration is not a construction drawing, but is used only to indicate the relative positions of various equipment. Where the pole-top switch must be placed more than one span from the transformer installation, the relative location of the switch and lightning arresters may be interchanged. A strip of 2-in. copper ribbon connected to a No. 6 wire is placed under the transformers to ground their cases.

Utility Uses Periodic Photos to Check Smoke

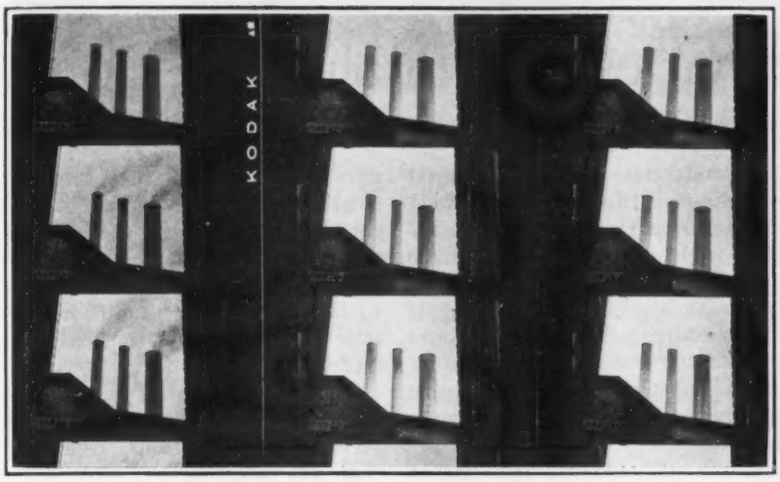
AN AUTOMATIC device for permanently recording smoke conditions is being used by the central heating department of the Detroit Edison Company at two of its centrally located plants. It consists of a motion picture camera, automatically operated to make one exposure of the tops of the plant stacks every ten minutes during daylight hours. The exposure includes also the date and time.

Aside from the value of the photographic record as an incentive to efficient furnace operation—the films are posted in the boiler rooms the day after they are made so that every man concerned can see the performance of the day before—the record may be shown to the local authorities to demonstrate the very small Detroit Edison contribution to the smoke nuisance and to indicate the earnest effort of the company to eliminate its contribution entirely.

A top view of the camera-driving mechanism is shown herewith. The mechanism is mounted on a cast-aluminum base and consists of a sewing machine motor, speed-reducing gear, circuit-closing solenoid, contacts and limit stop. The motor is of the universal type and the other parts of the set-up are so designed that the apparatus will operate equally well

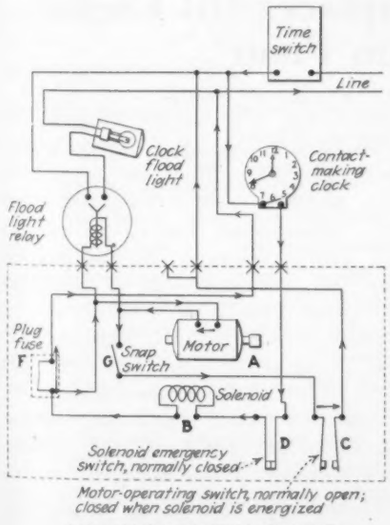


TOP AND SIDE VIEWS OF MECHANISM FOR PERIODICALLY PHOTOGRAPHING STACK DISCHARGE



SAMPLE OF SMOKE RECORD (DATE AND TIME BESIDE EACH VIEW)

on either direct or alternating-current supply. The electrical relations of the parts of the complete set are shown in the drawing. The primary control is vested in a time switch, which also operates a mechanical calendar by dropping a weight, which flops a date card down during the night. Every ten minutes the contact-making clock indirectly starts and stops the motor and flood light which is trained on the clock and calendar in front of the camera.



AUTOMATIC CAMERA CIRCUIT

The solenoid holds contact *C* closed while the motor drives the camera crank through one revolution. (The camera has been slowed from its normal speed to one exposure per revolution.) At the end of one crank turn the contact *D* is opened momentarily by a dog, the solenoid thus de-energized and the apparatus waits ten minutes for another clock contact. In addition to driving the camera, the motor slowly rotates a threaded shaft carrying a nut fixed against rotation to serve as a limit device and progress indicator.

The camera has a capacity of 200 ft. of film, and the apparatus could, if necessary, run about three weeks without attention were it not for the eight-day period of the time-switch and contact-making clock. The complete apparatus is set up in an open-ended box (about 10 ft. long and 3 ft. square) with the camera focused on the stack tops.

It is obvious that smoke detection is not the only application of this device. Any requirement of interval records can be filled by it. By returning the camera to normal film speed, motion pictures of any sort of operation or phenomena may be made by remote control. The device has been used in oil breaker tests; the same control switch that closes the oscillograph circuit starts the camera and a pictorial as well as a graphic record of the test is obtained.

The device is largely the product of L. S. Glover, chief of the photographic department, and E. A. Lueky, meter department, Detroit Edison Company.

Favors Inclosed Motors in Some Plants

FOR operation in dirty locations, where there is steam, ash or coal dust, totally inclosed or inclosed-ventilated motors are being favored by a few utilities. In some of these cases it has been found that open or semi-inclosed motors can't be "taken off the shelf" and applied satisfactorily to such special operating conditions. Service reliability compels totally inclosed or inclosed-ventilated motors in such locations, these devotees contend.

Inclosed motors are not used where coal dust is present in power plants, because explosions are feared. No trouble from this cause has been experienced or even presaged with open motors, declares one company that employs powdered-fuel combustion. However, dust, especially in the presence of moisture or oil, does clog ventilating ducts of open or semi-inclosed motors and cause burnouts. It is not always practicable to keep the ducts clean. Besides, the interest on investment in idle equipment when it must be cleaned must be added to the expense of cleaning as a charge against open or semi-inclosed motors. One company has found that the interest on idle investment due to burnout of motors from clogged ducts can easily justify buying inclosed motors.

Air Tampers Used in Backfilling Conduit Trench

Use of air tampers by Portland (Or..) Electric Power Company not only saves labor but lessens the possibility of settling and paving breaks

Commercial Activities and Public Relations

Suggestions for Load Factor Improvement

FOR greater economy in operation every one is seeking a means of increasing load factor. For better utilization of investment the same people are searching for ways of improving capacity or plant factor.

Some ideas were expressed recently by a group of utility men which are valuable if they do nothing more than stimulate expression of other ideas that have some possibility of application. It was quite generally agreed that system load factors will be increased by going after all kinds of business. Individual loads may have very poor load factors, but in the aggregate these loads, through diversity factor, will be helpful in solving the problem. While certain classes of business may be sought that have a relatively high load factor, there is danger that overcampaigning on one class of load may develop a new peak.

Supplying of power to water-power companies' systems while they are filling their ponds at night has been employed by one steam-generating company with beneficial effects. Summer service to customers having private plants when they do not need the exhaust steam for heating has also helped load factor. Although this practice leads to year-round service eventually and thereby removes part of the load-factor benefit, it cannot be condemned for this effect, as it constitutes a simple means of supplanting isolated-plant service.

Then there is the possibility of cutting peaks as contrasted with filling valleys. As an example one company was able to reduce its peak by having the railway company cut off car heating during the system peak, the heat radiated by the car occupants being relied upon to maintain sufficient temperature during that period.

If street lighting could be divorced from politics and sold on a high-intensity and all-night schedule, it would contribute greatly to better load factor, declared one man. Stimulation of the use of electric trucks would have its benefits in increasing the battery-charging load, which occurs chiefly at night.

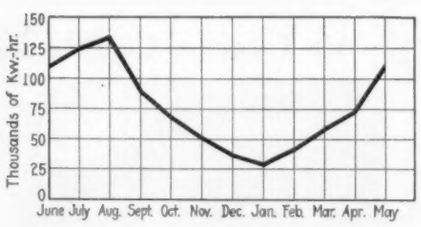
Some industries can be found (if a search is diligently conducted) which could carry on certain operations at night that involve very little labor but use power, for which an incentive to use could be offered, it has been contended. Shifting hours of operation for different groups of businesses just one hour would give great diversity. A few cases have been cited where this has been accomplished without rate inducement because of other benefits obtained thereby. Peak demands on human help or mechanical facilities are the cause of higher operating expenses than need exist for every business. If business as a whole can be convinced of this, a long step can be made toward reducing peaks on utility service as well.

To develop high load-factor business many people feel that rates must be reduced during off-peak periods to encourage it. Some say that offering off-peak rates will reduce the revenue already existent without developing additional revenue that will offset the loss caused thereby.

On the problem of keeping customers off the peak, there were suggested various solutions. One suggestion has been that simple control under lock and key might be developed to register all "on-peak" energy at a different rate. On the other hand it has been declared that peak power is not as costly as off-peak power, because the power-producing equipment used for peak supply usually consists of the obsolete equipment that would not be used otherwise.

Purchased Power Displaces Oil Engine in Ice Cream Plant

AS A RESULT of an economic analysis, an Eastern ice cream manufacturing plant, which was until recently generating a portion of its power requirements with a 150-hp. oil-engine unit and purchasing the remainder from the local electric utility, has contracted to purchase its entire electrical needs. Only the essential data developed are presented here, but a thorough study of the facts and conditions in each installation is necessary to arrive at a sound decision.



MONTHLY ENERGY REQUIREMENTS OF ICE CREAM PLANT

During a twelve months' period prior to the investigation the ice cream manufacturer used 918,412 kw.-hr., of which 556,010 kw.-hr. was generated by his oil engine unit and the remainder supplied by the utility. The cost of oil-engine power was computed as follows:

Carrying Charges:	
First cost of installation, 150 hp.	$21,000
Interest, 6 per cent	1,260
Depreciation on equipment (valued at $16,200) only at 9 per cent	1,458
Insurance and taxes, 2 per cent on equipment	324
Superintendence	1,000
Total	$4,042
Generating Costs:	
Labor	$2,080
Fuel	4,530
Water	821
Maintenance	810
Oil, waste and supplies	495
Total	$8,736
Total, including overhead	$12,778

Under superintendence it was estimated that if the amount of executive supervision of the power-producing plant were to be applied to the productive portion of the business, the returns would far exceed the cost, so $1,000 per year was taken as a conservative minimum. In computing the labor cost it was not contemplated that any of the employees would be dropped from the payroll by shutting down the engine, but it was considered that the full time of one man would be saved for other work. It was pointed out in the power engineering report which secured the business that in most oil-engine plants it is necessary to employ an operator in constant at-

tendance on the prime mover, this attendance being justified because the oil engine used was a high-grade and expensive piece of mechanism entitled to expert care and skilled adjustment in order to maintain reasonably high efficiency in operation.

In analyzing the fuel expense it was necessary to estimate the portion of fuel oil used by the engine, as the plant boiler also burned oil. From a test the efficiency of the oil engine under full normal load conditions over a period of five hours was 0.413 lb. per horsepower-hour. On account of the variation of the factory load this test-block efficiency could not be maintained over long periods of commercial operation. The tendency of the engine's efficiency to diminish through wear was also considered, and a base figure of 0.6 lb. of oil per brake horsepower was used in the comparison, this being equal to 0.805 lb. per kilowatt-hour at the flywheel.

The total energy output of the oil-engine-driven generator was 556,010 kw.-hr. At 88 per cent efficiency 632,000 kw.-hr. had to be produced at the flywheel. Hence the oil consumption figured 510,000 lb., or 71,800 gal., which at 6.3 cents per gallon equals $4,530.

Water for cooling purposes ran in the vicinity of 1 cu.ft. per horsepower-hour, or 1.3 cu.ft. per kilowatt-hour, costing, at 10 cents per 100 cu.ft., $821. Maintenance and repairs varied from year to year, but an average of 5 per cent on the equipment cost was taken in this case, and the cost of oil, waste and supplies was taken at 6 per cent of the combined labor, fuel, water and maintenance charges.

The cost of power supplied by the utility on the above arrangement was $10,622 for power (345,900 kw.-hr.) and $1,341 for light (16,232 kw.-hr.). The total cost of power estimated for the year was therefore $24,741, including oil engine and utility service.

Comparative Cost of Central-Station Service

The utility company's charges for 918,142 kw.-hr. over a year's run with a maximum demand of 200 kw. figured $17,430. To enable this service to be supplied from the 2,300-volt lines of the power company three 100-kw. transformers had to be purchased, and the cost of these installed with the necessary wiring and meter-house construction came to $3,500. Allowing 17 per cent overhead charges on this investment, or $595 per year, the comparative annual costs of the two methods of supply were:

OIL ENGINE AND PART PURCHASE OF ELECTRICAL ENERGY	
Overhead costs	$4,042
Electrical energy, light (purchased)	1,341
Electrical energy, power (purchased)	10,622
Electrical energy, (manufactured)	8,736
Total	$24,741
PURCHASED POWER	
Overhead costs on transformers	$595
Total electrical supply, (purchased)	17,430
Total	$18,025
Difference in favor of all purchased power	$6,716

Since the installation of complete purchased service the engineering department of the power company reports that this spread has, if anything, been increased. Collateral benefits include more reliable service (the oil engine was out of commission for nearly two weeks at one time in the summer during the peak of the ice cream business); elimination of engine noise and building vibration formerly encountered; obtaining of a slightly lower temperature in the factory basement, advantageous in refrigeration; doing away with a yearly overhauling of the engine, which occupied two men three weeks; elimination of executive supervision and cares of a prime mover, and utilization of space occupied by the prime mover by productive machinery.

Utility Selected to Direct Local Accident Prevention

THAT light and power companies can be a factor in bettering the safety conditions of other than their own employees is shown in the case of the Columbus Electric & Power Company, which has just been selected by the National Red Cross organization to direct the accident prevention work in its territory. Members of this company have also been awarded medals and proficiency certificates from the national organization for their skill in safety-first work. The appointment of the company and the awarding of medals and certificates to individual members came as a result of the company's sponsorship in 1926.

On Aug. 20, 1926, a first-aid contest was held among the various departmental teams. A silver cup was won temporarily by the generation department, and members of all teams were given silver watch fobs for their proficiency in the application of first-aid principles.

Keeping Individual Salesmen's Records

IN PLANNING its sales program for 1927 the commercial department of the San Joaquin Light & Power Corporation will use the form illustrated herewith to indicate each salesman's bogy and to show how nearly he is managing to meet his bogy.

The cost per kilowatt and cost per dollar of annual revenue have been worked out in advance for each salesman's bogy, taking into consideration monthly salary, automobile expense and miscellaneous expense. The revenue for each classification by months will be shown, so that each salesman will be informed in advance exactly what is expected of him, and so he may watch his progress and check up on his performance.

BASIS FOR RECORDING INDIVIDUAL SALESMEN'S PROFICIENCY

Month	Jan.	Feb.	Mar.	Etc.
Salary for month	....	....	....	
Auto expense for month	....	....	....	
Miscellaneous expense for month	....	....	....	
Total expense for month	....	....	....	
Domestic, commercial and street lights (kw.)	....	....	....	
Monthly revenue at $31 per kw	....	....	....	
Domestic and commercial combination service (kw.)	....	....	....	
Monthly revenue at $12.50 per kw	....	....	....	
General power (kw.)	....	....	....	
Monthly revenue at $14 per kw	....	....	....	
Agricultural power (kw.)	....	....	....	
Monthly revenue at $19 per kw	....	....	....	
Total monthly kw	....	....	....	
Total revenue per month all classes	....	....	....	
Cost per kw	....	....	....	
Cost per dollar of revenue	....	....	....	

Each salesman will be provided with one of these forms, with his bogy and estimated expenses shown, as well as the estimated annual revenue for the full twelve months. The annual bogy of the salesmen has been divided into twelve parts, and prorated into classifications and kilowatts in the proportion that it is expected the business can be secured monthly.

On the first of every month each man will turn in to the headquarters of the sales department his results for that month, so that a permanent record may be made of it. The total bogy for fourteen district salesmen and five men in the head office staff has been set at 28,750 kw., which it is expected will result in a

gross earning in twelve months after connection of $479,650.

As an aid to training salesmen and equipping them with the necessary technical knowledge of the business the practice of holding monthly sales meetings was followed during 1926. Manufacturers' and jobbers' representatives and other specialists engaged in various branches of the industry addressed these meetings on their particular subjects. N.E.L.A lessons previously turned in were also discussed. A great deal of technical and valuable sales knowledge as well as considerable general benefit has accrued to the men from such meetings, and it is planned to continue them during 1927.

Successful Lamp Campaign to Be Continued

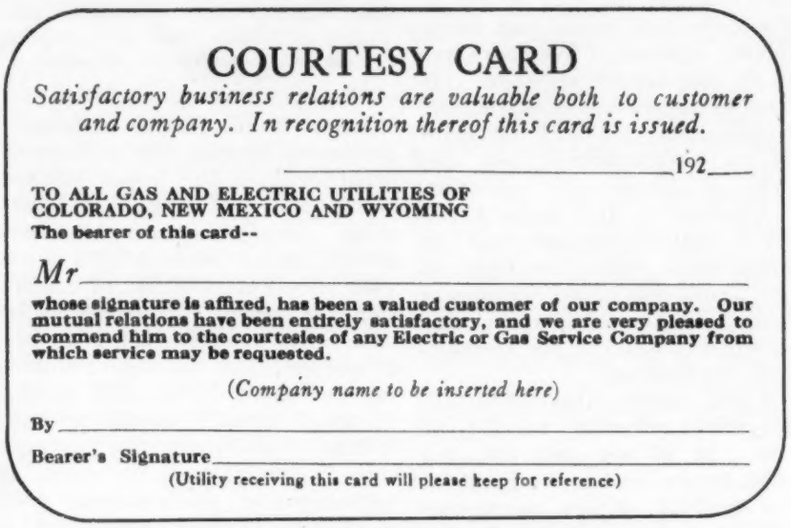
SO SUCCESSFUL has been the Mazda lamp campaign started on Sept. 1, 1926, by the Pacific Power & Light Company that it is planned to continue with a somewhat similar campaign during 1927. The 1926 campaign closed Dec. 31 with total sales in excess of 42,000 lamps. The quota of 50 cents in lamp sales per customer set for the districts was exceeded by five districts with average sales of 67 cents per customer. Sales per customer for the entire system were approximately 33 cents. Twice as many lamps were sold in 1926 as during 1925 despite the fact that the Pacific Power & Light Company serves a scattered territory, largely rural, in eastern Washington and Oregon and extending up and down the Columbia River for more than 200 miles.

The campaign was carried out largely through employees other than the regular appliance salesmen. Lamps were sold in six-lamp cartons at $1.80. Employees selling them outside of the office received a commission of 40 cents per carton, whereas office employees were paid a special commission of 20 per cent on the sales price in order to provide an additional incentive for pushing the lamps. Regular appliance salesmen did not put forth special effort on the sale of lamps, as they were busy on other appliance activities.

The success of the campaign is due largely to the effort put into it by employees and the large amount of advertising done. Salesmen's buttons, blotters, posters, inserts, stickers, cashier's slips, tape measures, rulers, stickers, special window displays, etc., were among the advertising mediums used.

Western Utilities Introduce Customer-Credit Indicator

A COMBINED introduction-credit-courtesy card is being supplied by utilities in Colorado, Wyoming and New Mexico to customers when moving from one locality to another within the states mentioned. Thus the good standing of a customer can be transmitted from one company to another and the embarrassment of asking him for a deposit can be eliminated. To accomplish this purpose it was concluded that the best method was to have the customer present such a recommendation personally, through the use of a "courtesy card." Official acceptance of this plan was restricted to companies in the states of Colorado, Wyoming and New Mexico, pending more general adoption and recognition.



COURTESY CARD

Satisfactory business relations are valuable both to customer and company. In recognition thereof this card is issued.

_____ 192___

TO ALL GAS AND ELECTRIC UTILITIES OF COLORADO, NEW MEXICO AND WYOMING

The bearer of this card--

Mr _____

whose signature is affixed, has been a valued customer of our company. Our mutual relations have been entirely satisfactory, and we are very pleased to commend him to the courtesies of any Electric or Gas Service Company from which service may be requested.

(Company name to be inserted here)

By _____

Bearer's Signature _____

(Utility receiving this card will please keep for reference)

COURTESY CARD WHICH WAS ADOPTED BY THE CO-OPERATING WESTERN UTILITIES

Conditions and Purposes for Issuing Courtesy Cards

Conditions

To be issued only to domestic customers in good credit standing when leaving a city (Prompt payment of all obligations for a minimum period of six months necessary).

Card to be issued with thought in mind that many utilities to which it is presented by holder will use it as basis of credit.

Card to interfere in no way with the rules and regulations of utility companies.

Purpose

Primarily to give the customer recognition of his good standing and to create in him an appreciation for the service and courtesy of the utility.

To remind the customer that good service is mutual and encourage future performance on his part.

To pass on to other utilities the good record of a customer.

To create incentive for a customer to pay all utility accounts before leaving a city.

To make possible elimination of demand for deposits from new customers when deposits are unnecessary.

Application

Card to be given or mailed customer only after payment of final bills.

To prevent possible use for credit purposes, card to be taken up by company to which it is presented.

For it to have a wide acceptance necessarily means that it must be issued under the same circumstances in all cases, as outlined above.

The success of this courtesy card depends on the care in issuance and the reception of the customer upon its presentation.

It was found necessary to familiarize all participating companies with the conditions and purposes of issuance of the card. Therefore a wall card of instructions was provided each company. It will be observed that this instruction card lays particular stress upon the necessity of all companies issuing the card under the same conditions. This is particularly essential, since the value of the card as a medium of credit will totally disappear if the receiving company cannot depend upon its reliability. Likewise the card will also lose its value to a receiving company unless the holder of the card is most cordially received.

Under the circumstances it was deemed advisable to have the receiving company take up and retain the card, inasmuch as it will have accomplished its purpose in establishing the holder's standing. By this action a customer will be made to feel that receipt of another credit card will depend on his prompt payment and fair treatment of the utility. Taking up the card also avoids possible misuse of it in securing credit with other than utility companies.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Overspeed Tests of Rotors for Hydro-Electric Generators.—R. NEWMANN.—The speed which a hydraulic turbine can attain when the load is entirely removed is limited, even when there is no automatic governor to maintain the variations of speed within moderate limits. Both hand-regulated turbines and turbines whose governors, for any reason, fail increase their speed only to a certain value which bears a distinct relation to that of the normal speed. By making simplifying assumptions it can be shown mathematically, according to the author, that this so-called runaway speed is double the normal. The actual value of the ratio betwen the two speeds is, however, generally somewhat different from 2. In the older literature the ratio is frequently given as 1.8. Present experience shows that, at least in reaction turbines, the ratio is not strictly equal to 1.8. In modern turbines, especially those with high specific speeds, it is frequently even greater than 2; values of 2.2 to 2.3, rising to 2.8 and more, are also obtained. The author proceeds to discuss the problems faced by the designer in deciding whether the improvement of the turbine performance, especially its efficiency, justifies the employment of a machine with considerably higher runaway speed than ordinary.—*A. E. G. Progress*, December, 1926.

Transmission, Substations and Distribution

Investigation Into Sectional Proportions of Cores of Circular Core-Type Transformers.—W. B. GARRETT.—Most designers appear to have an approximate method of obtaining the diameter of a core circle suitable for any given output and an equally approximate method of obtaining the core area capable of being contained within such a circle. In this article the writer gives the results of an investigation recently conducted into the correct sectional proportions of transformer cores, the object being to evolve a method of determining, simply and accurately, the proportions necessary to obtain the maximum core area in a circle of given diameter. The investigation embraces cores of two, three and four steps without ducts; of three, four and five steps with one duct, and of five steps with three ducts.—*World Power*, December, 1926.

Short-Circuit Currents.—G. CLULEY.—In this paper the writer undertakes to deal in detail with the calculations involved in a given distribution system. On simple systems the usual practice is to calculate short-circuit capacities on the percentage impedance principle; that is, to determine the percentage of impedance to the flow of the current in the lines, transforming and generating plant, on the basis of a given generating-plant capacity. Where, however, several stations are feeding a system and each station is of a different capacity, the satisfactory method of determining the short-circuit kva. is by what the author terms the relative-impedance method. This is one whereby the impedances of the various cables or overhead lines and transformer and generator windings are first calculated from the various capacities and per cent impedance and impedance diagrams prepared from which the total impedance to the flow of current at any given point can be computed. A specific set of values are used in demonstrating the mathematics of a satisfactory solution of short-circuit problems. The article is to be continued in a later number.—*Electrical Review* (*England*), Dec. 10, 1926.

Supervisory Control of Substations.—Substations equipped with apparatus which obviates the necessity of the continuous presence of attendants may be divided into two main classes. In one the sets are started up or shut down without manual intervention, in accordance with the changes in the load conditions, while in the other case the operation of the plant is controlled and supervised during running, either from the power station or from some other central position. The former arrangement carries the exclusion of the human element to the limit. While this arrangement embodies a number of ingenious devices which insure both correct operation of the plant and its immunity from damage should any mishap, such as overheated bearings, occur, its operation depends upon a drop in voltage consequent on the increase of the load. The result of adding a new machine to the line may be a disturbance, if only a temporary one, in the network conditions. In any event, the extra output follows the demand instead of preceding it. The second system is supervisory rather than fully automatic. It places the control of the substation plant in the hands of a load dispatcher and thus enables alterations in the load that can be foreseen to be dealt with before they take place. The human element can also assume control should any serious mishap occur. The author develops this subject at great length, using illustrations and graphs to demonstrate his point.—*Engineering* (*England*), Jan. 7, 1927.

Generation, Control, Switching and Protection

Cooling of Large Rectifiers.—O. SEITZ.—The surface of mercury-arc rectifiers of the steel-vessel type cannot be sufficiently enlarged to dissipate the heat losses fast enough to keep the temperature below about 50 deg. C. Water cooling must be resorted to, and this can be either direct, when an ample supply of fresh water is available, or by a closed and recooled water system. The latter method is used on all large installations. Depending upon circumstances and the choice of the customer, the used water may be recooled by natural self-cooling in radiators or in small air-blast coolers. A water-circulating pump is used in either case. An air-blast equipment will consume 700 watts for every 1,000 amp. direct current at an average rise of 25 deg. C.—*Brown, Boveri Company, Mitteilungen*, December, 1926.

Units, Measurements and Instruments

Formula for Inductance of a Helix Made with Wire of Any Section.—CHESTER SNOW.—The formula which is here obtained for the direct-current inductance of a single-layer helix takes account of the helical shape of the wire and hence of the axial component of current. It does not assume uniform current density over the section of the wire, but is correct to the second order for any current distribution which may be expanded by Maclaurin's theorem over the section of the wire. Formulas for circular and rectangular wires are obtained as simplified by the author. The paper also contains the exact solution for the field of a helical current filament of specific length.—*Scientific Paper No.* 537, *Bureau of Standards*, Nov. 10, 1926.

Ratio-Measuring Instruments.—G. W. STUBBINGS.—The author discusses here the class of instrument which measures the ratio of two electrical quantities. The most usual types of such instrument develop a torque on the moving system which is a function of the quantity to be measured. This torque may also vary with the position of the moving system, but from a basic standpoint the precise relationship between the torque and the magnitude of the measured quantity is not important. The moving system is subjected to some sort of control, which is derived either from the reaction of a spring or from gravitational forces. For each value of the measured quantity the moving system therefore takes up a definite position. The author takes one of the simplest types of these instruments and discusses in detail the basic principles of operation, paying particular attention to the mathematical relations involved.—*Electrical Times* (*England*), Jan. 6, 1927.

Illumination

Floodlighting.—W. J. JONES, H. LINGARD and T. CATTEN.—The successful solution of a floodlight problem depends according to the authors, upon a number of different factors which can be approximately grouped as follows: (1) Brightness of the installation, (2) choice of type of equipment, and (3) total energy required for installation. The accompanying tables gives some values of flood-candle intensities required on different building surfaces, taking into consideration the brightness of surroundings and the reflectivity of the surfaces. This table is based on the reflecting powers of different surfaces and a careful analysis of successful floodlighting schemes in the London district. The filament of a gas-filled lamp is not always uniform, the resultant beam from a plane parabolic mirror being invariably uneven and producing streaks on the lighted surface. There are several methods

FOOT-CANDLE INTENSITY REQUIRED ON BUILDING SURFACES

(Taking into consideration the brightness of surroundings)

Material	Condition	Reflectivity, per Cent	Foot-Candles, Lighted District		
			Poorly	Medium	Brightly
White glazed brick.....	Clean	85	2	3	5
Yellow brick.	New	35	4	6	10
Red brick....	New	25	6	9	15
Brick*.....	Dirty	1–5	.....	.....	.....
White marble	Fairly clean	60–65	2½	4	7
Granite.....	Fairly clean	10–15	13	21	33
Light concrete or stone	Fairly clean	40–50	3	5	8
Dark concrete or stone	Fairly clean	25	6	9	15
Concrete or stone*.....	Very dirty	5	.....	.....	.....
Concrete painted buff	New	50	3	5	8

*Usually requires too much light to be practicable.

by which this streakiness can be avoided: (1) Diffusing mirrors, (2) diffusing-glass fronts, (3) sectional mirrors, and (4) white lamps. Floodlamps can be divided into two types, those giving an intense and concentrated beam and those giving a wider and less powerful beam. The article proceeds in detail to analyze projection factors in floodlighting, the constructional design of the mirrors and projecting parts of the units, their cover glasses, and includes a discussion of the spill or waste light factors.—*Illuminating Engineer* (*England*), January, 1927.

Motors and Control

Present Limits of Large Direct-Current Machines—C. TRETTIN.—The purpose of this interesting paper is to determine the minimum size of a direct-current generator for a given output and speed and to show mathematically what maximum-output direct-current generator could be built in one unit with modern experience and materials. The first problem is as old as the design of electric machines and depends chiefly upon the judicious use of building materials and the economical curbing of heating. It concerns primarily the builder of the machine. The second question, which is the result of modern trend, is almost entirely a question of the commutator's performance and is of vital interest to the buyer of the machine. The author discusses limits for current and magnetic densities and calculates maximum commutator segment voltage. It seems that the latter cannot exceed 30 volts and that it represents one of the insurmountable limits. Mechanically the limitations have not reached such a definite stop. Circumferential speeds up to 110 m.p.s. are safely permissible today. However, the surface speed of the commutator reaches at 30 m.p.s. a critical limit beyond which difficulties arise from unreliable brush pressure. Examples are given of outstanding designs, built in the last years, among which are noteworthy generators for 6,375 kw., 150 r.p.m. and 15,000 amp. and a rolling-mill motor with 15,400 kw. pull-out capacity at 1,500 volts and 54 r.p.m.—*Siemens Zeitschrift*, November, 1926.

Traction

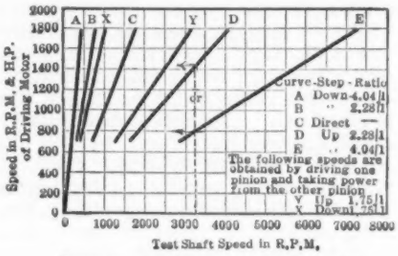
Electric Cable Car.—A. RUBIN.—The climb to the summit of Zug Spitze in the Austrian Alps has now been reduced to a ride of 19 minutes in a cable car. A straight right-of-way, through a territory with statistically the least danger from avalanches, has been established and cleared, and in this right-of-way five large steel towers have been erected at irregular intervals. Their location was determined by the contour of the mountain side. The towers carry a double set of steel cables, one set for the ascending car, the other for the descending car. The main suspension cable is 1.9 in. in diameter and has a rupturing strength of 176 tons (safety factor 3.1). There are two traction cables, of 1-in. diameter each, with a safety factor of 5.5 each. The cars are built from lightweight alloys, and each car holds 19 passengers. Their loaded weight is about 5,600 lb. each. The drive is installed in the valley station and is provided by a 65-hp. motor for the main traction cable and a 23-hp. motor for the auxiliary cable. An 80-hp. gasoline motor and a storage battery insure operation in case the main power supply from a nearby transmission system should fail. The motors drive sheaves 9 ft. in diameter, around which the traction cables are slung to form endless loops. A number of safety precautions have been installed to insure a maximum of reliability. One of the traction cables, insulated from ground and from the two other cables, provides telephone connection between the operator in the valley and the conductors in the two cars. A large part of this article is devoted to theoretical considerations of mechanical stresses, safety factors and wear of steel cables for installations of this type.—*Zeitschrift des Vereines Deutscher Ingenieure*, Dec. 25, 1926.

Electrophysics, Electrochemistry and Batteries

Pure Metals in Electrical Engineering.—L. T. SIDNEY.—Much work is being done by investigators both at home and abroad in the production of almost chemically pure metals. The methods employed are almost invariably electrical. Electrolytic separation from solutions of salts, followed by remelting and finally refining in high-frequency induction furnaces under a vacuum, are the methods chiefly in vogue. The electrical conductivity of a metal varies with the temperature and the composition and can be ascertained only by direct measurement and in comparison with a carefully selected standard. In the case of a pure metal the variation is, however, constant and according to a definite law. Moreover, the purest metals are invariably the best conductors, and although a strictly limited number of metals, such as lead, tin, cadmium and zinc, have been shown by Matthiessen to be capable of alloying together without "material" deterioration in their intrinsic conductive capacities, their alloys with other metals are always more resistant to the passage of the electrical current than the several metals composing them, taken individually. The accepted explanation of the higher conductivity of pure metal, according to the author of this paper, is that the absence of impurities preserves the complete regularity of the crystal structure.—*Electrician* (*England*), Nov. 26, 1926.

Miscellaneous

An Overspeed-Test House. — This paper describes the development and construction of a reinforced-concrete test house for the carrying on of experiments with low-speed waterwheel sets of large diameter and weight and with high-speed turbine rotors of great length but of only medium diameter and weight. Speed tests may be carried to destruction, if desired, in this shelter without risk to the attendants. Experience gained in recent years in connection with the construction of shelters for troops demonstrated that it was necessary to protect concrete shelters from the effects of bombs dropped from airplanes by covering them with bags of sand and rafts of timber. In the structure described in this paper the same line of reasoning was adopted, but as the forces to be resisted are



CURVES OF SPEEDS AND POWERS

of a reverse nature the absorbent lining is contained inside of the building. The speeds and powers which are available in the test house are shown by the curves. It is a coincidence that the motor used gives 1,800 hp. at 1,800 r.p.m., so that both power and speed, with any gear in use, can be given with one curve. Speeds beyond the limits given on the curve are obtained by supplementary gearing, speeds over 20,000 r.p.m. being obtainable. In ordinary routine work the dynamic balancing of rotors is carried out in this house and any necessary adjustment made up to any desired overspeed. Deflections can be measured and critical speeds checked and recorded by means of a vitograph.—*Engineer* (*England*), Dec. 31, 1926.

Influence of Cold-Working on the Physical Properties of Wire.—A. J. MICHEL. — Generally speaking, cold-working is mechanical work carried on while the temperature of the metal is below the annealing temperature. In the specific case of cold-working of iron and steel it is mechanical work carried on while the temperature of the material is below the critical range. The author proceeds to describe the marked changes in the physical properties of cold-worked wire and the reasons as they are known to the industry. He gives several typical examples and includes a group of photo-micrographs of cold-rolled metal in various states.—*Wire and Wire Products*, January, 1927.

News of the Industry

Pennsylvania Rural Service

Commission Changes Order of Last Year to One Based on Agreement Reached by Farmers and Companies

THE general order issued by the Pennsylvania Public Service Commission a year ago providing for extension of electric facilities to rural districts was revoked by the commission at Harrisburg on Wednesday. To supplant it, the commission issued a new general order which is expected to provide cheaper rates for rural electric service for both power and light. The new order is the composite work of the commission, representatives of the Pennsylvania Electric Association and representatives of the State Council of Farm Organizations. The revised order is effective April 1, and companies are required to file their rates under it by March 1. New features of the order include extension of lines to rural consumers at city rates, co-operative arrangements by which groups of rural consumers can obtain service through a single meter, and contribution of labor or materials by consumers in extending the lines, in return for which they are to receive credit in rate making.

Of the electric interests affected, 90 per cent are said to favor the new order, and the State Department of Agriculture has given it high commendation in a statement which Charles G. Jordan, Secretary of Agriculture, says is not his own but expresses the opinion of the farm and electric organizations which co-operated in obtaining the new order. Only a few weeks ago the farmers' organization and the electric companies reached an agreement much of which is embodied in the new order, which is to be known as General Order No. 28.

The original order required power companies to extend their lines at the demand of at least one contracting consumer per measured mile of line, the company to pay all costs of extension if there were three or more contracting consumers to the mile and $300 per contracting consumer if less than three. The new order requires the company to pay the entire cost of all extensions, permitting, however, voluntary contributions by consumers toward this cost, but requiring that due credit for such contribution shall be given when establishing or revising guarantees of revenue. "Whereas the original order predicated the companies' obligation to depend upon the number of consumers in a measured mile, the new order makes the obligation to extend dependent upon the present or prospective business to be obtained along the extension," the commission explains. "No definite requirements as to rate forms," it goes on, "were contained in the Pinchot plan adopted a year ago, but the new order requires the companies to adopt a simple rate structure for rural service, leaving the companies free to establish the details and amount of the rates as their several necessities dictate, subject, of course, to review by the commission."

To extend the electrification program to cover the greater part of rural Pennsylvania will require at least ten years and $80,000,000, engineers say.

New Members on Pennsylvania State Commission

Richard J. Beamish and Chris Golden, members of the Pennsylvania Public Service Commission by appointment of former Governor Pinchot, were rejected by the Senate at Harrisburg on Tuesday. Immediately after the vote Governor Fisher submitted the names of Emerson Collins of Lycoming County and Samuel Walker of Butler County, both lawyers. They were unanimously confirmed. John W. Brown of Lancaster County, a Pinchot appointee, was also confirmed. Beamish, a lawyer, and Golden, a miner, were appointed by Governor Pinchot especially as "people's" representatives.

Balch Hydro Plant Starts

Throwing the switch on the new 40,000-hp. Balch hydro-electric plant of the San Joaquin Light & Power Company, A. G. Wishon, president of the company, brought into operation on Saturday afternoon, Jan. 29, the first power plant to be constructed on the Kings River, in central California. This plant is 56 miles east of Fresno. The plant is constructed to permit of the installation of additional units as demand for power dictates. At the ceremonies Henry Hawson, vice-president of the Fresno County Chamber of Commerce, acted as presiding officer, and Ezra Decoto, president of the California Railroad Commission, made the principal address.

Engineering National Section Meets in New York

A group meeting of the several committees of the Engineering National Section of the National Electric Light Association was held in New York on Feb. 2, 3 and 4, when important progress was made on the year's program. On Wednesday evening the visitors were entertained at dinner by the Metropolitan Section of the N.E.L.A. John W. Lieb gave some interesting historical details of the early days of the steam engine at this meeting, and Chairman C. F. Hirshfeld outlined briefly the necessity for engineers to study new developments in the art if they would keep abreast with developments of value to the industry.

Committee meetings were held on the morning periods of Thursday and Friday. In the afternoon inspection trips were made to new engineering projects in the New York area, including the East River station of the New York Edison Company. More than 300 members were present and the meetings were very successful.

Hudson Station Celebration

Brooklyn Edison Company Entertains a Thousand Guests to Mark Its Formal Opening

CONSPICUOUS even among the many great generating plants that have gone into service in the last few years is the Hudson Avenue steam station of the Brooklyn Edison Company, on the Brooklyn side of the East River. The company, noted both for its enterprise in taking advantage of new developments in engineering and operation and for its strikingly successful cultivation of good public relations, entertained on Wednesday, Feb. 2, at the Hudson Avenue power house a thousand invited guests to mark the formal opening of the station. Among them were not only well-known engineers and electrical men from all parts of the country, but public utility commissioners, city officials, bankers, industrialists, business men and other representative citizens of Greater New York and its most populous borough.

Although ground for this station, which is designed for an ultimate rating of perhaps 750,000 kw., was broken as late as 1922, it already contains four turbo-generators, with an aggregate capacity of 230,000 kw. Of these the latest is the most remarkable. This is an 80,000-kw. cross-compound Westinghouse unit, which went into service on Sept. 1 last year and was fully described in the ELECTRICAL WORLD for Sept. 4 (page 465). It was the first object to which the visitors' attention was directed as they started on a tour of the plant under the guidance of company employees, whose oral descriptions of the installation were greatly aided by the clear and non-technical explanations printed on large cards attached to every piece of equipment. Another method helpful in promoting lay understanding was the manner in which certain turbines, boilers, circuit breakers and other apparatus were exhibited to expose their internal construction.

The celebration began with a buffet lunch at 12.30 p.m., after which M. S. Sloan, president of the company, ascended a gallery at one end of the turbine hall and by means of amplifiers which carried his voice to the other end told about the company, its investment, its methods and its aims. He was followed by William A. Prendergast, chairman of the New York State Public Service Commission, who felicitated the Brooklyn Edison Company on the service it was rendering and expressed his faith in private generation and sale of electricity under state regulation.

Cyanamid and Farmers' Bids Rejected

But House Committee Appoints Seven Members to Conduct Negotiations with These Two Companies Over Changes in Their Muscle Shoals Offers

By PAUL WOOTON
Washington Correspondent ELECTRICAL WORLD

EFFORT to bring about congressional action on Muscle Shoals still encounters difficulties, and as this is written there is great doubt whether either a new bill or the offer of the associated Southern power companies, which was reported favorably by the joint committee appointed by the Senate and the House, will be voted on finally in the three weeks remaining of this Congress. As already reported, the military affairs committee of the House departed, under pressure, from the customary procedure when a bill on a certain subject is on the House calendar and opened hearings on the revised American Cyanamid Company bid, and also on the offer of the Farmers' Federated Fertilizer Corporation. Any testimony from those interested in the bid of the power companies was barred. The committee did another unprecedented thing in virtually agreeing that the amount of the return to the United States Treasury was not to be a determining factor in the comparison of offers.

After nearly a week of hearings the committee found that neither the Cyanamid nor the Farmers' Federated offer was satisfactory to a majority. A sub-committee was named to confer with the bidders in the hope of obtaining an offer which a majority of the committee will approve. The sub-committee numbers seven, with James of Michigan as chairman.

W. B. Bell, the president of the American Cyanamid Company and of its subsidiary, the Air Nitrates Corporation, in his testimony declared that his organization is the only concern in the United States which is really expert in the manufacture of synthetic nitrogen fertilizers. He declared his willingness to amend the offer so as to make 50,000 tons the amount of fixed nitrogen which the company would agree to make under the conditions set forth. He said the probable cost of power at Muscle Shoals would be $17 per horsepower-year.

Representative Madden, whose reasons for supporting the American Cyanamid Company's offer were summarized in the ELECTRICAL WORLD last week, expressed the opinion that the appropriations committee, of which he is chairman, could be relied upon to favor appropriating funds to build the Cove Creek Dam and Dam No. 3.

Analyses which have been prepared of the Cyanamid company offer attempt to show that the profit to the lessee would be enormous. The power which would be produced at the Wilson Dam, Dam No. 3, Cove Creek, Senator Dam, Melton Hill, Clinton Dam and at the steam plant would aggregate, it is figured, about 3,500,000,000 kw.-hr. of primary power a year. This would cost the lessee slightly more than 2 mills per kilowatt-hour. Since prime power should bring 4 mills, it is pointed out that the lessee on such a basis could sell power below the cost to public utility companies and still leave several millions of annual subsidy on the power alone. Five per cent of all power would be required to fix 50,000 tons of nitrogen and another 5 per cent for the phosphoric-acid furnaces. This leaves close to 1,000,000 hp. that the United States would be exchanging for the production of a maximum of 50,000 tons of nitrogen if it could be sold at a profit. If Congress does not build the Cove Creek Dam, then the maximum becomes 20,000 tons. The amount guaranteed under any and all circumstances is 2,500 tons. Suspension of the water-power act would prevent development by others on the Upper Tennessee and on the Clinch River. No payment would be required for the value of storage and stream regulation, as is provided in the water-power act. The Cyanamid company bid requires the government to put in $75,000,000 of new money, on which the return would be 1¾ per cent. Were the same amount at the same cost invested in the latest nitrogen-producing equipment, about 500,000 tons of nitrogen could be fixed at one-third the probable cost by the cyanamid process.

These are some of the points made against the Madden bill. That a portion of the committee is anxious to induce the Federal Power Commission to take no action on Upper Tennessee applications until Muscle Shoals is disposed of definitely was obvious.

A spectacular feature of the hearings was an attack on Major General Jadwin and Colonel Fiske by Representative James, who presided at the hearings. This attack was based on the fact that Colonel Fiske asked the seven rival applicants for power sites on the Tennessee River if they would be willing to contribute among them $20,000 to continue certain important features of the work. The money advanced was to be repaid as soon as the necessary appropriation became available. This proposal Mr. James stigmatized as improper. While the whole matter was apparently open and above-board, some difference of opinion on its legality exists.

Tri-State Colorado Conference Adjourns

The tri-state conference between representatives of California, Arizona and Nevada, which had been in session in Los Angeles since Jan. 10, adjourned Jan. 25 to meet again Feb. 7. This conference has been held for the purpose of working out some mutually satisfactory method of developing the Colorado River and the fair distribution of its waters. A statement issued by Charles P. Squires of Nevada, chairman of the conference, said that "the recess was taken to allow the representatives to consult in their respective states and to give the commissioners time for more full consideration of the problems involved." No information was forthcoming with respect to progress made, but it is understood that the representatives are still attempting to determine an equable figure which California would be willing to pay Arizona for power derived from the river.

In Washington Senator Johnson of California has issued an attack on the rules committee of the House of Representatives, which he accuses of bottling up the Boulder Canyon Dam bill despite administration influence. Senator Johnson, without advancing any proof, also accused an unnamed representative of a prominent holding company of declaring that the interests he represented "do not propose to let the government enter the power business at Boulder Canyon."

Midwest Power Conference

Program for Second Chicago Assemblage Arranged—Central-Station Men Have Prominent Place

SPONSORED by the local and regional divisions of the American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Mining Engineers, National Electric Light Association, Western Society of Engineers and National Safety Council, the second Midwest Power Conference will be held at the Coliseum, Chicago, on Feb. 15 to 18. It is expected to prove even more successful than the first conference, held last year, when nearly 1,400 representatives registered. The Power Show to be held in connection with the conference will consist of exhibits by 250 manufacturers, and the latest equipment and practice in connection with power generation, distribution and utilization will be demonstrated.

The program for the Midwest Power Conference, of which W. S. Monroe, president Sargent & Lundy, is chairman of the committee of arrangement, follows:

Tuesday, Feb. 15.—"The Middle West and the Power Conference," W. S. Monroe; "Increasing Value of Power to Home and Industry," W. W. Freeman, president Union Gas & Electric Company, Cincinnati.

Wednesday, Feb. 16.—"The Use of Power in Steel Mills," W. Sykes, Inland Steel Company, Chicago; "The Use of Power in the Food Industry," Joseph J. Merrill, Corn Products Refrigerating Company; "The Use of Power in Paper Mills," V. D. Simons, Chicago; "Recent Power Developments in the Cement Industry," J. H. Lendi, Universal Portland Cement Company; "New Developments in Industrial Power Plants," S. G. Neiler, Neiler, Rich & Company; "The Use of Power in the Packing Industry," C. H. Kane, Swift & Company.

Thursday, Feb. 17.—"Economies of Coordinating Gas and Electric Power Supply," Samuel Insull, Jr., president Midland Utilities Company; "Recent Electrical Development," Paul Clapp, managing director National Electric Light Association, New York.

Friday, Feb. 18.—"Location of and Coal for Central Power Plants," Samuel A. Taylor, president American Institute of Mining and Metallurgical Engineers, Pittsburgh; "Recent Developments in Coal Burning," F. S. Collings, Sargent & Lundy, Chicago.

Inspection trips to important power plants will be made. On Thursday evening Samuel Insull will address the banquet at the Palmer House.

In the Legislative Mill

Utility Men in Texas Opposed to Setting up Commission—Regulatory Body in Illinois Is Attacked

TWO utility-regulating bills, differing little, are now before the committee on municipal and private corporations and common carriers in the lower house of the Texas Legislature. They are designed to bring all public utilities in the state under the authority of a commission. Regulation of electric light and power companies by the state is deemed impracticable by these interests, according to a statement made by W. B. Head of Dallas, chairman of the board of directors of the Texas Power & Light Company. Mr. Head appeared before the committee in opposition to the pending bills. He asked that the power utilities be not burdened with two "bosses." Dallas and the other larger cities will oppose taking away their home rule powers, Mr. Head declared, and regulation by both the city and by the state will bring much trouble to the utilities. He thought the size of Texas made statewide regulation inadvisable.

A bill now before the Indiana Legislature would prevent hydro-electric companies with plants in that state from impounding water during off-peak periods and using it for peak loads and would compel the hydro companies to maintain below their dams the natural flow of the streams.

A strong fight for the abolition of the Illinois Commerce Commission is being made in the Legislature by the Illinois Municipal League. The East St. Louis City Council on Jan. 24 passed a resolution presented by Mayor M. M. Stephens in support of a bill providing for city supervision of public utilities instead of the present system.

Elimination of the present 20-year limit on franchises in Illinois has been recommended by the Illinois legislative committee that has been investigating the subject for the past two years. After reviewing its investigation the committee says in its report: "This committee therefore recommends that appropriate legislation be adopted at this session of the General Assembly removing the present limitation of 20 years as the maximum term for which franchises may be granted to street railways and authorizing the issuance of terminable permits to public utilities operating within this state, under such terms and conditions as may be deemed wise by this General Assembly to insure continuous and efficient operation of the utilities and to protect the public as to service and rates and its rights in and to streets."

A bill introduced in the Maine Legislature provides that only expenditures for the production of energy used in the state plus not more than 10 per cent for surplus production shall be considered in fixing a rate base for light and power plants.

Blame for delay in state water-power development is placed on Governor Smith in the report of the New York State Water Power Commission, submitted to the Legislature this week. No recommendation as to future water-power policy is made, but the report declares that if New York does not act quickly in developing the St. Lawrence, Ontario, now ready to go along with New York on the development, will turn to Quebec for power.

The electrical industry is the target of a number of bills introduced in the Nebraska Legislature in addition to those mentioned last week. One of these would enable the city of Omaha to become a competitor of the Nebraska Power Company by providing that the utilities district may extend the electric plant now operated in connection with its other industries so as to supply public and private consumers. Another bill limits the charge that electric companies may make in municipalities under 15,000 population—that is, all save Omaha and Lincoln—to 7 cents a kilowatt-hour for lighting and 3 cents an hour for power purposes. A third bill would validate all issues of bonds that were made by rural electric lighting districts under a law declared unconstitutional four years after its passage.

Governor Fuller Out to Lower Rates

Chief Executive of Massachusetts Thinks High Dividends Show that Earnings of Electric and Gas Utility Companies Are Excessive—Sends Letter to Utilities

A CAMPAIGN to lower utility company rates has been started in Massachusetts by Governor Alvan T. Fuller, who in his opening address to the Legislature at Boston said:

"Gas and electric companies in this commonwealth are receiving earnings which, in many instances, seem excessive. While stockholders should receive a fair return on their investments and while the dividend rate should be such as to attract new capital when needed, it is equally true that the public is entitled to purchase gas and electricity at fair prices. When the consumer is compelled to pay rates for gas or electricity which result in excessive dividends to the stockholder, he is being treated unfairly and is entitled to relief at the hands of the commonwealth.

"An examination of the dividends paid by various gas and electric companies during the last four years indicates that the returns to the stockholder are excessive for a public utility. [Here the Governor gave in tabulated form the dividends paid in 1922 to 1925 inclusive by electric companies in Northampton, Milford, Quincy, Worcester, Cambridge, Gloucester, Ayer, Attleboro, Leominster, Malden and Springfield, combined gas and electric companies at Charlestown, Beverly and Lynn and gas companies at Northampton, Williamstown, Adams and Cambridge, percentages in the first-named group running in 1925 from 15 to 55.] While the dividend rates quoted are on stock at par and in a number of instances do not reflect the rate upon the money actually invested in these public utilities because many issues of stock have been sold at a substantial premium, nevertheless, they do demonstrate that, in some of the companies at least, the rates charged the consumers are altogether too high.

"Under existing law the method provided for securing a reduction in gas and electric rates is inadequate. . . . The Department of Public Utilities should be responsible to the public for establishing and maintaining reasonable rates. In my opinion, the Department of Public Utilities should be authorized upon its own initiative, as well as upon complaint, after a hearing, to reduce rates for gas and electricity whenever it deems such rates unjust or unreasonable. I recommend that legislation to this effect be enacted.

"The Public Utilities Commission should be the guardian of the public interest. They should require reports and be able to analyze them so that they can secure a proper relationship between returns to the stockholder and charges to the consumer, always bearing in mind that the consumer has not been afforded that best protection which can be given to any consumer, namely, competition for his patronage. The advantage of this competition has been denied him by giving utility companies a monopoly. Therefore the responsibility rests heavily upon some public body to see to it that he is fairly treated.

"Is it not surprising that all of our public service companies have not learned the lesson that the interests of the company can be best served by meriting the confidence and good will of the public? . . . If control of these companies should pass to outside interests, we might face a situation in which persons over whom we have no control had the power to do lasting injury to these public utilities and to the public who use them. Already the control of our telephones is in a foreign corporation. I recommend legislation to meet this situation. As there are a number of these holding companies organized under the laws of our commonwealth, the amendment to the law should be so drafted as to apply to holding companies, whether domestic or foreign."

GOVERNOR WRITES COMPANIES

Governor Fuller followed up his recommendations first by a letter to the chairman of the Department of Public Utilities, Henry C. Attwill, asking for "an estimate of the reduction that should be made in the charge for electricity by different electric companies to their customers, based on their capital plus premiums and earnings," and then by the following letter addressed to the electric light companies operating in Attleboro, Malden, Springfield, Charleston, Quincy, Worcester, Cambridge, Gloucester, Lynn, Ayer, Leominster, Williamstown and Adams:

"I write to inquire if your company anticipates making a reduction in rates to your patrons. I find there are a number of companies which are quite willing to agree that their earnings are such as to warrant sharing their pros-

perity with their consumers by reduction in rates. I am having a study of this question made by the Commission on Public Utilities, but it occurred to me that many companies would be willing, and might in fact prefer, voluntarily to make such rates as their earnings and general financial situation justified. If this is a matter which you are considering or propose to consider in the immediate future, I should be very glad to know of it."

The latest development was the tabulation by the Governor in the Boston *Herald* for Jan. 30 of reductions which he proposes shall be made in the rates of these companies, according to three separately drawn schedules. In arriving at his conclusions, he says: "It is assumed that the operating expenses, fixed charges, provision for depreciation and revenue will be this year substantially what they were during the calendar year of 1925, or, putting it another way, that the results of their operation will be as favorable this year as in 1925. It is also to be understood that the results are derived from mathematical calculations based upon the sworn returns of these companies to the Public Utilities Department and are calculated upon the assumption that 8 per cent upon the fair value of the capital stock and premiums paid thereon would be a reasonable return in the one instance, 8 per cent upon stock, premiums and earnings invested in plant in another, and 8 per cent upon the book cost of the property in the third instance."

At a legislative committee hearing on Tuesday of this week the electric light and power companies expressed themselves in favor of granting the power of initiating rate inquiries to the Department of Public Utilities.

Lighting Equipment Men Meet with Other Groups

The Artistic Lighting Equipment Association held its annual convention and fixture market at the Hotel Hollenden, Cleveland, this week, with a registration of 2,000. This association was formerly called the Association of Lighting Fixture Manufacturers. The National Association of Lighting Equipment Dealers held its convention jointly with the fixture market. Nearly a hundred manufacturers participated in the market, and the association won high praise for the success it has achieved in the last year. At the last convention there was a membership of 47 and a debt of $10,000. It was announced at this convention that the membership had grown to 128 manufacturers and the organization had a bank balance of $10,000 as a result of the efforts of President Farmer and Managing Director Roger.

In addition to the regular meetings were included the conference of the Illuminating Glassware Guild, the stamping and parts manufacturers, the illuminating glassware manufacturers, the floor and table lamp manufacturers, the wiring devices and supply manufacturers, the Northern Ohio Association of Electragists and the New York Lighting Fixture Merchants' Association.

The program embraced a broad discussion of the problems of the manufacture and sale of lighting equipment and its application in illuminating practice, with detailed consideration of special interests in the group conferences. The Artistic Lighting Equipment Association is engaged in the promotion of a five-year program for the co-ordination and advancement of the fixture industry.

Fight Staged Over Abolition of Indiana Commission

Friends and foes of the Indiana Public Service Commission will have an opportunity to present their views in a public hearing to be held by the state legislative committee on public rights and franchises. The chairman of the committee, Senator Cann, has introduced a bill which would abolish the Shively-Spencer utility act of 1913 and restore the former Railroad Commission, which preceded the present Public Service Commission. Under the Cann plan regulation of public utilities would be restored to local governmental units.

Judging from advance activity, the Indiana commission is up against the stiffest fight it has had to wage since it was created. Organizations of various natures from many sections of Indiana are communicating with their representatives in the Assembly urging them to abolish the commission, which has regulatory power over all light and power, gas, water, telephone, bus, interurban and railroad companies in the state.

Western Inspectors Assemble in Kansas City

The twenty-second annual meeting of the Western Section of the International Association of Electrical Inspectors, which was formerly known as the Western Association of Electrical Inspectors, was held on the roof of the Kansas City Athletic Club, from Jan. 25 to Jan. 28, with 24 states and Canada represented by the 350 inspectors attending. The meeting was presided over by the president, James S. Mahan of the Western Actuarial Bureau, Chicago.

The first day and a half were devoted to reports of committees on the various articles of the National Electrical Code and the proposed revisions in some of these. After the reports were read the meetings were thrown open to discussion by members. A committee of five was appointed to make notes on the best points of the reports and compile them for the executive committee, which will make a final report to the electrical committee. Article 5 of the code (dealing with wiring) was discussed at some length and the hope expressed that a section can be evolved which will meet the needs of the whole country and still be, as now, a statement of minimum standards. Dana Pierce, president of the Underwriters' Laboratories, Chicago, was present and aided in shaping conclusions.

The third day was devoted to addresses, among the subjects being "Inspectors' Problems and How to Solve Them," "Professional Ethics as Applied to Electrical Inspection," "The Contact of the Public Utility with Electrical Inspection," "The Contact of the Electrical Manufacturer with Electrical Inspection," "Elimination of Sub-standard and Non-approved Electrical Materials and Appliances," and "Progress Made with the International Association Idea." Discussions followed most of these addresses.

The delegates were taken on a tour of inspection by the Kansas City Power & Light Company to its Northeast station, where supper was served. The last day was given to inspection trips. New officers were elected as follows: President, John W. Kelly, Jr.; first vice-president, H. R. Markel; second vice-president, W. A. Haig; secretary-treasurer William S. Boyd. L. A. Barley of Denver was reappointed chairman of the executive committee.

L. E. Gettle Deplores Cost Ruling of Supreme Court

Testifying before the joint finance committee of the Wisconsin Legislature on Jan. 26, Chairman L. E. Gettle of the Wisconsin Railroad Commission deplored, according to the newspaper reports, the recent "spot reproduction" cost decisions handed down by the United States Supreme Court and applying to valuation of public utility plants for rate-making purposes, on the ground that these decisions weakened greatly state regulation of public utilities by the Railroad Commission. Mr. Gettle declared that the method favored by the highest federal court, and therefore necessarily by the state courts, means increased values for rate-making purposes on every utility in Wisconsin.

Denver Engineer Opposes Public Service Franchise

Franklin P. Wood of the firm of Wood & Weber, Denver, consulting engineers, who was employed by the Denver Chamber of Commerce to report upon the proposed city franchise of the Public Service Company of Colorado, which will be voted upon on Feb. 8, has reported adversely to its adoption. Instead, Mr. Wood advocates a plan of partnership between the city and the Public Service or another company to be set up, by which the city will eventually acquire and operate the system. Control would be vested in the company until the plant was paid for, which, he holds, should be within twenty years.

Asserting that local business men stand ready to advance the $25,000,000 needed, if the Public Service refuses to accept, Mr. Wood thinks that the franchise is unnecessary and would only serve as a means of issuing more bonds, of which, he declares, far too many are outstanding. By Mr. Wood's plan the Valmont plant of the Public Service company would be purchased at $25,000,000, to raise which bonds at 5 per cent would be issued. The new organization set up would be administered by officers representing security holders and not by the city appointees.

Against Government Help

N.E.L.A. Wants No State Aid in Rural Service—Public Utility Courses in Educational Institutions

UNQUALIFIED opposition to government subsidy, ownership or operation of electric service was voiced by the national executive committee of the National Electric Light Association when it met in New York City recently. The committee unanimously adopted a resolution previously passed and submitted to it by the executive committee of the Public Relations Section of the association. The resolution particularly stressed the position of the electric light and power industry opposing "the advocacy of government subsidy or construction of facilities for rural electric service as unsound, uneconomic and unnecessarily discouraging to the efficient efforts now being made to extend rural service."

The adoption of this resolution followed the presentation of facts showing the rapid development being made in the study of rural electrification problems under the auspices of the National Committee on the Relation of Electricity to Agriculture, composed of representatives of farmers, manufacturers, central-station companies, home economics and women's clubs and federal departments. The resolution was occasioned by frequent recent announcements from individuals advocating the building of rural transmission and distribution lines by state governments or under state subsidies.

Merchandising Activities

Chairman J. E. Davidson, reporting upon the activities of the Commercial Section, told of the increased interest in merchandising being shown by member companies in all parts of the country. He spoke particularly of the co-operation with the General Federation of Women's Clubs, through its local and state organizations, in conducting a survey and also in endeavoring to improve the standard of living of homes throughout the country. He stated that at the request of Mrs. Mary King Sherman, president of the federation, a representative of the electric light and power industry will be appointed in each state to co-operate with the state organizations of the federation.

Chairman W. A. Jones of the Public Relations Section called particular attention to the work of the committee on co-operation with educational institutions, of which Carl D. Jackson is chairman. He said that this committee held a meeting in Chicago early in January, at which time a definite program for carrying on the work was outlined. This includes the employment by headquarters of a qualified educator experienced in research to make a survey of the country, with particular respect to the colleges and universities which include public utility courses in their curricula; also a comprehensive study of the public utility material included in textbooks now in use in the higher educational institutions. The Public Relations Section was authorized to expend such a sum as may be necessary for carrying on this part of the work through the remainder of the current administrative year. Efforts will also be made to have this work decentralized and carried on more actively through the geographic divisions.

Reporting for the exhibition committee in connection with the annual convention, to be held at Atlantic City, Chairman E. W. Goldschmidt said that the amount of exhibit space already contracted for exceeds the total amount of exhibit space used by manufacturers at the N.E.L.A. convention a year ago. He anticipated a larger and much more interesting exhibit, particularly from the public viewpoint. He announced that the exhibition would open Saturday afternoon, June 4, at 1 o'clock. Heretofore the exhibit has opened Monday morning. This year it will be open not only Saturday afternoon but on Sunday.

Pacific Gas & Electric Has Big Program for 1927

Approximately $20,000,000 will be spent on construction in the near future by the Pacific Gas & Electric Company, according to estimates by the company's operating heads. The largest project is the development at Salt Springs, which calls for a rock-fill dam, 220 ft. high, across the Mokelumne River, a reservoir of at least 50,000 acre-feet capacity, a 25-mile water conduit, a 44,000-hp. generating plant at Tiger Creek and the raising of the installation at the company's Electra power house from 26,000 hp. to 44,000 hp. This program, however, will spread over four years, and only preliminary work will be undertaken this year.

Work on the Melones power house, which is to take water from the reservoir built on the Stanislaus River by the South San Joaquin and Oakdale irrigation districts, is going ahead on a schedule which calls for completion on June 1. Everything is ready for the erection of the superstructure and installation of equipment which will add 36,000 hp. to the company's rating, at a cost of $2,500,000. On the Spaulding-Dunn development the two Lake Spaulding plants are to be replaced by larger ones and a third plant is to be built, increasing the capacity of the Dunn power house from 50,000 hp. to 67,000 hp. Spaulding Nos. 1 and 2 will be replaced this year, and the third plant will be ready in the spring of 1928. A fourth plant is in contemplation. Appropriations already made for the Spaulding-Dunn work aggregate more than $2,000,000. In the Shasta division the dam for the coming Pit River plant No. 4 is to be completed and will be used at present to furnish an afterbay for Pit River Plant No. 3.

The company's San Francisco division is to spend half a million on new work, the East Bay division the same amount for transmission lines alone, the Sacramento division still another half million for rebuilding the Davis substation and other work, and the San Jose division $400,000 on the Newark-Coyote tower line and $100,000 on a new substation at Monte Vista.

Tasks of Purchasing Men

Utility Group Considers Relations of Buying Department to Rest of Company Organization

EMPHASIS on intelligently directed purchasing as an important factor in the operation of public utility companies was the keynote at the convention of the utility group of the National Association of Purchasing Agents held in Detroit on Jan. 27, 28 and 29. The chairman of the meetings was E. T. Gushee, purchasing agent of the Detroit Edison Company, and he, in addition to the duties of presiding officer, contributed in no small measure to the excellent discussions that followed every paper.

The principal specific topics concerned the relations that exist between the purchasing department and the other company divisions, executive, stores and engineering. It was made clear that the purchasing agent who acts simply as a bargain seeker independently of other company interests is extinct. His place is taken by a man in close contact with every other department who not only analyzes market conditions but keeps himself continuously informed of material and equipment requirements in his own company. He does this by studying statistical compilations and graphical representations of company conditions.

The desirable qualifications and the development of persons with these qualifications into effective components of purchasing department personnel was the subject of a paper by W. D. Chandler, secretary of the association. A discourse on "Research," indicating the probable new types of devices and materials purchasing agents would be expected to buy in the near future, was made by C. W. Stone, manager of the central-station division of the General Electric Company. In his paper on "The Use of Charts and Statistics in Purchasing," E. L. Stapleton, chief statistician of the Eastman Kodak Company, referred to the barometer curves developed and published by the ELECTRICAL WORLD as among the best indicators of business conditions available. The discussion of Mr. Stapleton's paper, with specific reference to business barometers in utility purchasing, was led by Douglas Dow of the Detroit Edison Company.

Following an address on "Common Sense in Specifications" by C. F. Hirshfeld of the company just named, there was a purchasing agents' symposium led by Lewis A. Jones of the Adirondack Power & Light Corporation, Schenectady, N. Y. This covered stores control, savings by purchasing departments, standardization of materials, routine information from other departments, etc. "The Commodity Outlook for 1927," as depicted by H. N. McGill of Babson's Statistical Organization, also engaged the delegates' attention.

Speaking at the banquet, A. C. Marshall, vice-president and general manager of the Detroit Edison Company, referred to the generally favored position of public utility securities, but deplored the fact that some consolidations had been put through on terms that will not be justified by the systems' earnings.

Purchases and Mergers

More Oklahoma Properties Change Hands—Georgia Merger Consummated—Activities Elsewhere

IN ADDITION to the transfers of Oklahoma properties noted last week, announcement is made of the purchase of electric light and power plants in Guthrie, Mulhall, Langston, Perkins, Coyle and Vinco from the Public Service Company of Oklahoma by the Oklahoma Gas & Electric Company. These properties are adjacent to the last-named company's lines, and service can more conveniently be given by that company than by the Public Service Company of Oklahoma, which has its headquarters in Tulsa. The Oklahoma Gas & Electric has bought the Gage as well as the Shattuck plant from the Southwestern Light & Power Company.

Following the dismissal of an injunction suit brought by minority stockholders to prevent the merger of the Georgia Railway & Power Company, the Georgia Railway & Electric Company, the East Georgia Power Company, the Rome Railway & Light Company and the Athens Railway & Electric Company into one organization to be known as the Georgia Power Company, permission for the merger was granted by the Georgia Public Service Commission last week. The consolidated companies, as already recorded, have all been taken over by the Southeastern Power & Light Company.

Other transactions reported follow:

By a majority of 638 votes in a special election the Board of Commissioners of North Wilkesboro, N. C., has been empowered to sell the municipally owned electric distribution system and franchise to the Southern Public Utilities Company of Charlotte, N. C., for $65,000. Within the past few months the towns of Mount Airy, Elkin, Kernersville, Wingate, Marshville and Madison, N. C., have voted to sell their power plants to the Southern Public Utilities Company, and more recently the town of Stoneville took the same step.

Ness City, Kan., has sold its municipal light and power plant to the Western Light & Power Company. This company is now negotiating with the city of Ransom for the purchase of its transmission line and distribution system.

Cedar Vale, Kan., has contracted to sell its generating plant and distribution system to the Inland Utilities Company, Kansas City, Mo. A twenty-year franchise will be granted, subject to the approval of the Kansas Public Service Commission.

Approval of the Kansas Public Service Commission has been given to the sale of the municipal plant and distribution system of Moran, Kan., to J. E. Houdashelt.

The City Council of Orleans, Neb., has sold its distribution system in that city and a transmission line to Alma to the Western Public Service Company for $40,000.

The West Texas Utilities Company has purchased the electric and ice properties in Spur, 100 miles northwest of Abilene, Tex.

The Tennessee Electric Company has purchased the electric light system, of the city of Lafollette.

Citizens of Guyamon, Okla., have voted by 285 to 6 to sell their municipal light and power plant to the Industrial Utilities Company.

The Central Illinois Public Service Company has been authorized to buy the public utility properties at Littleton, Ill., as well as the Perry Light & Power Company in Pike County.

The City Council of Lamar, Mo., has voted to put to a vote the sale of the city's light and power plant to the Ozark Utilities Corporation. The Empire District Electric Company and the Cities Service Corporation also sought a franchise. The Ozark Utilities Corporation offers the city $125,000 cash and free city lighting for five years.

Negotiations for the sale to the Appalachian Power Company of the municipal electric plant of Martinsville, Va., which have several times been reported as progressing, are thought to have come to a stalemate, no agreement upon price having been reached between the respective representatives of the company and the city.

Briefer News

Bethlehem Meeting of A.I.E.E. Postponed.—The Bethlehem (Pa.) regional meeting of the A.I.E.E. has been postponed one week and will therefore be held on April 21-23.

Gathering of Virginia Engineers.—One hundred and fifty engineers from all over Virginia met in Norfolk on Jan. 21 to hear addresses on the development of electric power stations and other topics. Vern E. Alden of Stone & Webster, Boston, and L. W. Wallace, secretary of the American Engineering Council, were among the speakers, "Tendencies in Power Station Design" being the subject of Mr. Alden, while Mr. Wallace discussed "The Activities of the American Engineering Council."

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 1, page 80.]

Eastern Association of Electrical Inspectors—Philadelphia, Feb. 9. E. P. Slack, 85 John St., New York.

Northwest Electric Light and Power Association, Commercial Section—Multnomah Hotel, Portland, Ore., Feb. 10 and 11. G. C. Sawyer, Pacific Power & Light Co., Portland.

American Institute of Electrical Engineers—Midwinter convention, New York, Feb. 7-10; Southwestern District, Kansas City, March 17-18; Middle Eastern District, Bethlehem, Pa., April 21-23. F. L. Hutchinson, 36 West 39th St., New York.

New Mexico Utilities Association—Franciscan Hotel, Albuquerque, Feb. 14-16. B. L. Wiles, Albuquerque Gas & Electric Co., Albuquerque.

Kentucky Association of Public Utilities—Brown Hotel, Louisville, Feb. 18 and 19. E. F. Kelley, Louisville Railway Co., Louisville.

Iowa Section, N.E.L.A.—Dubuque, Feb. 24 and 25. H. E. Weeks, Davenport, Iowa.

Oklahoma Utilities Association—Huckins Hotel, Oklahoma City, March 8-10. E. F. McKay, 307 Local Building, Oklahoma City.

Northwest Electric Light and Power Association, Engineering Section—Portland, Ore., March 10 and 11. O. L. LeFever, Northwestern Electric Co., Portland.

National Electrical Manufacturers' Association, Policies Division.—Briarcliff Manor, N. Y., March 17-18. S. N. Clarkson, 30 East 42d St., New York.

Southeastern Division, N.E.L.A.—Peabody Hotel, Memphis, Tenn., April 13-15. C. M. Kilian, 404 Wynn-Claughton Bldg., Atlanta.

Southwestern Division, N. E. L. A.—New Orleans, April 26-29. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Southwestern Public Service Association—New Orleans, April 26-29. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Nebraska Section, N. E. L. A.—Grand Island, Neb., April 27-28. H. M. Davis, 1519 O St., Lincoln.

American Electrochemical Society—Benjamin Franklin Hotel, Philadelphia, April 28-30. Colin G. Fink, Columbia University, New York.

Missouri Association of Public Utilities—Cape Girardeau, May 5-7. F. D. Beardslee, 315 North 12th St., St. Louis.

Middle West Division, N.E.L.A.—Topeka, Kan., May 18-20. H. M. Davis, 1519 O St., Lincoln, Neb.

List of Municipal Plants Sold Last Year Goes Up Ten.—The National Electric Light Association's list of municipal electric plants sold to private operators last year has gone up from 105 to 115. Iowa had 25 such cases, not 14, as first reported, and one error on the other side (Frankenmuth, Mich., which was not a municipal plant) was discovered.

Missouri Power & Light Company to Span Missouri River.—The Missouri Power & Light Company is about to carry its transmission lines across the Missouri River at Osage City as part of an expansion program involving service to nine or ten towns in Gasconade and Osage Counties. A high steel tower will be erected on each bank of the river.

Herkimer, N. Y., Not to Abandon Municipal Plant.—Reports that the municipal lighting plant at Herkimer, N. Y., is to be abandoned are denied there. The voters, however, have defeated a bond issue for the purchase of additional equipment, and a contract with the Utica Gas & Electric Company for standby service has been made.

Iowa Men to Discuss Operating Problems.—The 1927 convention of the Iowa Section, N.E.L.A., will be held in Dubuque on Feb. 24 and 25. The program will be largely given over to operators, and economy and efficiency in operation will be the main theme. Separate meetings of commercial men and engineers will be held on the first day and a general meeting on the second.

Sectional Meetings of North Central Electric Association.—The North Central Geographic Division of the N.E.L.A., which comprises Minnesota and North and South Dakota, will again this year follow the policy of holding sectional meetings. Those already scheduled are: St. Cloud, Minn., Feb. 16; Albert Lea, Minn., March 16; Sioux Falls, S. D., April 13.

Saskatchewan Would Like to See Its 35 Water-Generated Horsepower Grow.—A commission has been appointed by the government of the Province of Saskatchewan, Canada, to inquire into the economic practicability of generating electric power at central plants and at hydro sites and distributing it throughout the province. Saskatchewan, with a population approaching a million, is served almost entirely by municipal plants. Water power on its streams has a potential value of 1,087,800 hp., but, owing to the remoteness of the sites from the cities, only 35 hp. has up to the present been developed.

Tecumseh Plant to Be Enlarged.—Plans have been completed for additions to the Tecumseh plant of the Kansas Power & Light Company, Topeka. The Tecumseh station, the com-

pany's principal power unit, was placed in service as recently as January, 1926, but the first unit, of 15,000 kw. capacity, is already loaded, the company, which serves Topeka and Atchison, Kan., and St. Joseph, Mo., through this station, has announced. Work has begun on the second unit, which will include the installation of a new 22,500-hp. turbine and double the present installed capacity of the plant.

New York Electrical League Elects Officers.—Officers of the New York Electrical League were elected unanimously at a luncheon on Dec. 27 as follows: President, Joseph F. Becker; vice-presidents, Earl Whitehorne, Theodore H. Joseph and William A. Kennedy; treasurer, Lawrence L. Strauss; secretary, David T. Brown. John W. Lieb described the New York Edison Company's new generating station. Arthur Williams presided.

Would Develop Power on Arkansas River in Oklahoma.—T. C. Hughes and associated engineers of Tulsa, Okla., have made application to the Oklahoma Drainage, Irrigation and Reclamation Commission for permission to divert the water from the Arkansas River at a point near Kaw City and conduct it through a concrete canal for 14 miles to a point near Fairfax, where the water, after generating 30,000 hp. of energy, would be emptied into Salt Creek. This plan gives a fall of 152 ft. The cost of the project is put at $2,000,000.

To Facilitate Water-Power Development in Nebraska.—The Nebraska Irrigation Association at its annual convention recently passed resolutions urging upon Congress that it remove all barriers to the development of electric power by the state and by irrigation districts in order that such power may be developed in connection with the reclamation service of the federal government. The resolution points out that the state has no law permitting water-power districts and that the federal government has not granted the irrigation districts created under the reclamation act the necessary power to dispose economically of the power incidentally developed. There are two government projects in the North Platte valley where it is contended that hydro-electricity could be developed cheaply.

Hurley Prize Jury Appointed.—The Hurley prize awards jury has been announced by J. E. Davidson, chairman Commercial National Section, N.E.L.A., to consist of C. E. Greenwood, Edison Electric Illuminating Company of Boston, chairman; G. E. Miller, Cleveland Electric Illuminating Company; S. D. Heed, Electric Household Utilities Corporation, Chicago; Earl Whitehorne, commercial editor ELECTRICAL WORLD, and Ell C. Bennett, editor *Electric Light and Power*. Mr. Davidson also announces that the closing date for submitting material for competition in the Hurley merchandising contest has been extended to March 1 instead of Feb. 1 as originally announced. The prizes are offered to electric light and power companies making the most constructive contributions toward developing a more effective method of merchandising electrical household appliances. They are three in number, amounting respectively to $5,000, $3,000 and $2,000. The rules adopted for the contest were printed in the ELECTRICAL WORLD for Jan. 23, 1926 (page 216).

Many Thousands Attend Opening of Penn Central Office Building. — The Penn Central Light & Power Company was on Saturday, Jan. 22, from 2 to 10 p.m., host to a great throng, estimated by the local press at more than 25,000 people, at its new office building, Eleventh Avenue and Twelfth Street, Altoona. The structure combines in high degree beauty, convenience and utility. The principal officers of the

company, including the new president, Harry Reid, were there to welcome customers and citizens.

New Unit for Pasadena Recommended.—Recommendation to install an additional 15,000-kw. unit in the Pasadena (Cal.) municipal power plant is made to the City Manager by Benjamin F. DeLanty, general manager of the utility. With the proposed addition the city's plant would, he says, be able to care for the growth of the department for five years.

National Museum of Engineering Elects New Officers. — The board of trustees of the National Museum of Engineering and Industry announces the election of new officers and a new program. Hereafter efforts will be devoted to holding together and increasing the membership until it is determined whether the fund-raising activities on which efforts have hitherto been concentrated can be resumed with good augury. Thomas Ewing, former Commissioner of Patents, was elected to the presidency of the trustees, in place of Samuel Insull, and the office of consulting secretary was established, to be filled by H. F. J. Porter. The vice-presidents are Edward G. Acheson, L. H. Baekeland, Charles F. Brush, Thomas A. Edison, Frank J. Sprague, Edward Weston and Orville Wright. Harrison W. Craver is secretary and George E. Roberts treasurer.

First Gatineau Unit Undergoes Trial. —The first unit in the new power house of the Gatineau Power Company at Chelsea, on the Gatineau River, Quebec, has been turned over for the purpose of tuning up—one year and 77 days from the commencement of construction. This is the first of the five 34,000-hp. units which are being installed in this power house. The initial power will be distributed to the new newsprint plant of the International Paper Company at East Templeton, on the Ottawa River, about 10 miles from Chelsea.

Progress of Holyoke (Mass.) Water Power Company.—On Dec. 30, 1926, the Commonwealth of Massachusetts issued a license to the Holyoke Water Power Company covering the construction of a hydro-electric plant at the Holyoke end of the dam which was built across the Connecticut River at Holyoke about 1898. This license not only authorizes the construction of a power house, but the excavation of a discharge channel from it, so as to produce a normal head of 45 ft. under ordinary conditions. It is expected that by the construction of a river wall the available head upon the wheels can be maintained during freshet periods. In the fall of 1926 a 110,000/66,000-volt interconnection was made across the Connecticut River from the power plants of the Holyoke Water Power Company to the transmission system of the Turners Falls Power & Electric Company, in order to provide facilities for a free interchange of energy. Another high-tension river crossing has been authorized by both state and federal authorities, and it is expected that steel towers will be erected in the coming spring at the ends of the existing stone dam. This will provide a means of transmitting across the river to the town of South Hadley electrical energy in bulk for distribution by its municipal plant.

Electrical Consolidation in St. Louis District.—Under the terms of the sale contract of the Venice (Ill.) power plant of the Illinois Traction Company for $4,125,000, to the Union Electric Light & Power Company of Illinois, subsidiary of the North American Company, the Illinois Traction Company will purchase power from the Union Electric for a period of twenty years, beginning at the rate of $1,000,000 per year. The Venice plant, which has a rating of 30,000 kw., is at the east end of the McKinley Bridge over the Mississippi River. Within the last two years it has been modernized. Construction of a steel-tower transmission line for operation at 66,000 volts connecting the Venice and Cahokia plants is under way. This line with substations at the terminals will cost $1,000,000. The sale brings under one general management virtually all the light and

power operations on both sides of the Mississippi River in the vicinity of St. Louis. Previously the Union Electric Light & Power Company of Illinois was in control of the electrical facilities of East St. Louis and vicinity extending as far east as Belleville and as far north as Hartford and Mitchell, Illinois.

Decatur, Ala., to Get Large Access of Power.—Power available in the Decatur district will be more than quadrupled through a new 110,000-volt primary substation of the Alabama Power Company, for which plans are well under way and major electrical equipment has been purchased, local officials of the company announce. The new station will have a rating of 7,500 kw., which will be in addition to the 2,250 kw. already available in the district over the 44,000-volt circuit from Huntsville. A location in the vicinity of the Connecticut Mills has been tentatively selected for the new plant. The switch house will be of brick and will be similar in architectural features to the company's home office in Birmingham. Power for the station will be taken from the 110,000-volt line connecting Huntsville and Sheffield.

Rise of the Genesee River Threatens Harm to Rochester Dams. — Rising water in the Genesee River very recently caused some apprehension at Rochester, N. Y., both the million-dollar state dam that governs the flow of the river through the center of the city, below the Barge Canal harbor, and the new dam being erected by the Rochester Gas & Electric Corporation just to the north of the state structure being thought for a short time to be in danger. Considerable damage to machinery and equipment at the private dam was inflicted. The latter is being rushed to completion after numerous delays due to high water. Its purpose is to provide additional power for the wheel pits down stream by impounding water in the Barge Canal harbor. One of the three sectors of the new dam is nearly finished, but it is possible the other two will not be installed until after the usual spring rise.

Public Service of New Jersey Construction.—Two large switching stations, one erected at Trenton and the other at Athenia, N. J., have been completed by the Public Service Electric & Gas Company, operating subsidiary of the Public Service Corporation of New Jersey. These two stations cost $4,000,000. The Trenton station is the northern terminus of the 32-mile transmission line carrying current from the Philadelphia Electric Company to Public Service territory. It is equipped with two banks of transformers, each made up of three single-phase units of 10,000 kva. each, giving a present capacity of 60,000 kva. The ultimate rating is expected to be double this. At Athenia the switching station, similar in construction to that at Trenton, stands on the Newark branch of the Erie Railroad. The initial installation will be 90,000 kva. and the ultimate capacity 180,000 kva. Power will be received from the new Kearny generating station, 11 miles away.

Men of the Industry

W. C. Fisher Heads Empire State Association's Electric Section

W. C. Fisher, who was elected chairman of the Electric Section of the Empire State Gas and Electric Association, as announced in the Jan. 29 issue of the ELECTRICAL WORLD, has been identified with public service companies in the Westchester County section of New York State for the past nine years. His early experience included connections with the Interborough Rapid Transit Company, New York City, in

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the capacity of testing engineer and with the Flatbush Gas & Electric Company, Brooklyn, at first as engineer and subsequently as superintendent. Removing his interests to the Middle West, Mr. Fisher took charge at Massillon, Ohio, of the production work of the Griscom-Russell Company, which manufactured material for the Navy Department during the war. Later he spent one year with the American Agricultural Chemical Company as engineer in charge of mechanical and electrical work in all of the company's plants in the United States. Since 1918 he has been chief electrical engineer of the Westchester Lighting Company, vice-president and general manager of the Northern Westchester Lighting Company and vice-president and general manager of the Peekskill Lighting & Railroad Company.

Mr. Fisher is a graduate electrical and mechanical engineer. He is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and for four years has been a member of the high-tension committee of the Empire State Gas & Electric Association.

Dr. Adolf Franke, president of the Siemens & Halske Gesellschaft of Berlin, has been made the recipient of the Siemens-Stephan memorial plate by the Deutscher Elektrotechnischer Verein of Berlin. This is the society's highest award and is granted every five years to the person who is considered to have rendered the greatest service to electrotechnical progress in general and to the society in particular. Dr. Franke has been associated with the Siemens & Halske Company for 40 years and is known for his work in connection with high-frequency measurement apparatus for telephony and with wireless-wave measurements.

E. Van Arsdel Succeeds Mr. Reid in Indianapolis

Ernest Van Arsdel, formerly vice-president and general manager of the Interstate Public Service Company, Indianapolis, Ind., has been elected president of that utility to succeed Harry Reid, who, as previously announced in the ELECTRICAL WORLD, has assumed new duties with the National Electric Power Company. Other changes in personnel to become effective at the annual meeting of the company, to be held March 7, are as follows:

Vice-president in charge of gas, electric and water operation, I. L. Oppenheimer; vice-president in charge of railway operation, L. M. Brown; vice-president and treasurer in charge of the financial department, W. Marshall Dale; vice-president and auditor in charge of accounting and stores, A. D. Jones. G. J. Oglebay, now district manager of the Bedford district, will go to the Indianapolis organization as assistant to the vice-president in charge of the gas, electric and water operation.

Edward G. Jay has been appointed manager of the Metropolitan Electrical League of Boston, with temporary headquarters at 39 Boylston Street.

Thomas N. McCarter, president of the Public Service Corporation of New Jersey, departed for a vacation in Florida Jan. 29. Mr. McCarter will return to his duties early in April.

Lee De Forest, inventor, left New York Jan. 28 aboard the Italian liner *Roma* for a short sojourn in Italy. Mr. De Forest's itinerary will include Naples and Genoa.

Loyall A. Osborne, president of the Westinghouse Electric International Company, sailed for Europe Jan. 28 aboard the Italian liner *Roma*. Mr. Osborne will visit Naples and Genoa.

W. R. Matthews, formerly illuminating engineer with the Washington Water Power Company, Spokane, is now connected with the Miller Company, with headquarters in San Francisco.

David M. Jackson, president of the Lincoln Park Board, Chicago, has been named chairman of the Illinois State Commerce Commission by Governor Len Small, succeeding Frank L. Smith. **Alexander Johnson**, Chicago, was named to the commission to succeed Judge Cicero J. Lindley, and **J. Paul Kuhn**, Batavia, will succeed William Burkhardt, Chicago.

B. G. Smith, formerly district manager of the Public Service Company of Northern Illinois at Chicago Heights, has been transferred to Oak Park to succeed Harry L. Judd, recently promoted to be assistant to one of the company's vice-presidents.

N. E. Funk of Philadelphia Receives Promotion

Nevin Elwell Funk has been appointed assistant chief engineer of the Philadelphia Electric Company, with duties assigned by and reporting directly to W. C. L. Eglin, vice-president and chief engineer. The appointment carries with it full authority to act for the chief engineer during the latter's absence. He succeeds Horace P. Liversidge, who as vice-president was assistant chief engineer for many years. Mr. Liversidge in addition to being vice-president is general manager, as announced previously in the ELECTRICAL WORLD. Mr. Funk is a graduate of the Bloomsburg (Pa.) State Normal School and of the class of 1905, Lehigh University, specializing in electrical engineering. He began as an apprentice with the Westinghouse Electric & Manufacturing Company. Later he was a subforeman with the New York Central Railroad and an assistant professor at the Georgia School of Technology, Atlanta.

He began his work with the Philadelphia Electric Company as assistant foreman in the station electrical construction department and filled successively the positions of assistant superintendent, combustion engineer, superintendent of Schuylkill station, assistant operating engineer and still later operating engineer, which position he held prior to his elevation. He is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, Franklin Institute, American Mathematical Society and the American Society for Testing

N. E. FUNK

Materials. He is chairman of the lubrication sub-committee of the prime movers committee of the National Electric Light Association, chairman of the power station betterment sub-committee of the same committee and was chairman of the Philadelphia Electric Company Section, N.E.L.A.

He is succeeded as operating engineer by C. C. Baltzly, formerly assistant operating engineer, who began his career with the company as cost engineer and on Dec. 1, 1924, was appointed assistant operating engineer.

Frederic H. Hill, vice-president and general manager of the Elmira (N. Y.) Water, Light & Railroad Company, has been elected president of the Elmira Association of Commerce for the ensuing year. Mr. Hill is associated with every important civic movement carried on for the benefit of the city.

Paul A. Schoellkopf, president of the Buffalo, Niagara & Eastern Power Corporation, Buffalo, has been commissioned a major in the Chemical Warfare Corps of the Officers' Reserve Corps, according to an announcement made by the United States War Department at Washington.

Luke C. Bradley, president of the Virginia Electric & Power Company, has been named chairman of the committee on industry and power development of the Virginia State Chamber of Commerce, according to the announcement of the president of that organization.

Lionel J. Bourke, secretary to Vice-president William H. McGrath of the Puget Sound Power & Light Company, has just been appointed assistant to the vice-president. Mr. Bourke, who was born at Yoakum, Tex., is a graduate of the Texas Agricultural and Mechanical College, where he took a B.S. degree in electrical engineering, graduating in 1922. In July of the same year he entered the employ of Stone & Webster of Boston and in March, 1923, joined the Puget Sound Power & Light Company as a student engineer, being appointed resident manager at Elma, Wash., in February, 1923. On Dec. 1, 1924, he was appointed secretary to Mr. McGrath in the executive offices in Seattle.

Eugene W. O'Brien has resigned from the engineering staff of Jenks & Ballou, Providence, R. I., to become editor of the *Southern Power Journal*, with headquarters in Atlanta. Mr. O'Brien was graduated from Brown University in electrical engineering in 1918 and taught general engineering there until 1923, when he went to the Sheffield Scientific School of Yale University to take charge of the materials-testing laboratory. He joined the staff of Jenks & Ballou in 1925. He has taken the degrees of M.S. at Brown and M.E. at Yale and has been active in the power-plant engineering field in addition to his educational work. Recently he was concerned in the reconstruction and expansion of the South Street station of the Narragansett Electric Lighting Company at Providence.

Prof. Elihu Thomson, director of the Thomson research laboratory of the General Electric Company at Lynn, Mass., has been notified that he has received the Faraday medal for 1927 of the Council of the Institution of Electrical Engineers of England. The award is made for "notable scientific or industrial achievements in electrical engineering, or for conspicuous services rendered to the advancement of electrical science." This is not the first occasion on which Professor Thomson has received recognition in Great Britain for his attainments in the field of electrical engineering, he having been the recipient of the Kelvin gold medal in 1924. This medal, which was founded in 1914 by British and American engineers, is awarded triennially by the presidents of the representative British societies.

F. H. Cole Vice-President of Pacific Electric Company

Fred H. Cole, who recently assumed the duties of vice-president and manager of the St. Louis factory of the Pacific Electric Manufacturing Company, San Francisco, engaged in railroad work with the Union Pacific organization before he entered the light and power field as an employee of the Union Light & Power Company of Junction City, Kan. Subsequently he affiliated himself with the Atchison

F. H. COLE

(Kan.) Railway, Light & Power Company and later with the Phonex Construction Company at Omaha. After discharge from military service he joined the Texas Construction Company to engage in work in Dallas and Wichita Falls, Tex. Severing his connection with that organization, he identified himself with the Texas Power & Light Company before being appointed a vice-president of the Pacific Electric Manufacturing Company.

Joseph P. Grace, president of W. R. Grace & Company, has been elected a director of the Engineers' Public Service Company.

F. E. Wiatt, formerly general foreman of substation construction and later design engineer in charge of substation design for the Union Gas & Electric Company of Cincinnati, is now connected with the engineering department of the Southern Sierras Power Company at Riverside, Cal.

Allen D. Turner has resigned as sales promotion manager of the Westinghouse Electric & Manufacturing Company for New England to take the post of secretary and sales manager of the William B. Rand Company, Boston, printer and house-organ publisher. Mr. Turner was formerly in charge of automotive advertising for the Westinghouse company, with offices at Springfield, Mass., and was also active in the convention exhibit work of the company. He is well known in New England electrical circles.

D. E. Ackers, manager of the Kansas Power & Light Company's properties at Atchison, Kan., has been made manager of the company's Topeka properties, it has been announced by Albert M. Patten, vice-president and general manager for Kansas. The appointment is effective immediately. The post to which Mr. Ackers has been promoted is a new one. The company's

Topeka holdings are its most important properties in the state. Mr. Ackers will have charge of construction work on the additions to be made to the Tecumseh power station, 5 miles east of Topeka. He has been with the Kansas Power & Light Company since 1924. **Ralph H. Love**, manager of the Hiawatha (Kan.) properties, will succeed Mr. Ackers at Atchison and will also retain supervision at Hiawatha.

Lucius Rossiter, formerly vice-president and treasurer of the Terry Steam Turbine Company, Hartford, Conn., has been elected president, to succeed Douglas H. Thomson, who died recently. Mr. Rossiter has been associated with the Terry company since 1913.

W. A. Wadsworth, general manager of the Michigan United Light & Power Company, has been appointed general manager of the Michigan Public Service Company. Mr. Wadsworth will retain the general managership of the Michigan United.

F. A. Swanson, formerly district superintendent of the Michigan United Light & Power Company, Ludington, has been transferred to the Michigan Public Service Company, Cheboygan, where he will be in charge of operations. Both these properties are controlled by the General Engineering & Management Corporation.

Obituary

S. B. Frank, special representative of the Mutual Electric & Machine Company, Detroit, died at Cleveland Jan. 10 in his forty-eighth year. Mr. Frank was well known in electrical jobbing circles and among electrical contractors.

James G. Bateman, assistant sales manager for the National Tube Company in New York and vice-president of the Engineers' Club, died Feb. 1 of pneumonia in his forty-ninth year. Mr. Bateman was a native of Easton, Md. He was identified with the Erie Railroad before affiliating himself about fifteen years ago with the National Tube Company.

Ernest E. Schmid, president and treasurer of the Shield Electric Company, New York, died Jan. 25 of pneumonia at his home in Hollis, Queens Borough. Mr. Schmid, who was 46 years of age, held patents for many inventions in the field of high-tension power transmission. He was a member of the A.I.E.E.

Charles Cooper, formerly president of the Municipal Electric Light Company and the Citizens' Electric Illuminating Company, before they were merged with the Brooklyn Edison Company, died at his home in Brooklyn, N. Y., Jan. 21, in his sixty-ninth year. Mr. Cooper had long been prominent in public utility corporations and in banking circles, and at the time of his death he was vice-president of the Nassau & Suffolk Lighting Company, a trustee of the Brevoort Savings Bank and a member of the advisory board of the Hamilton Trust branch of the Chase National Bank.

Recent Court Decisions

Injunction Against Georgia Merger Refused.—Holding that the act of 1909 under which it is proposed to merge the Georgia Railway & Power Company with five other power companies in Georgia is constitutional, an Atlanta court has denied a petition of injunction and sustained a general demurrer against stopping the Georgia Public Service Commission from holding a hearing on the proposal. The plaintiffs, representing approximately 4,400 shares of stock in the Georgia Railway & Power Company, sought to prove that they were being unjustly deprived of valuable property by the terms of the merger and attacked the constitutionality of the act of 1909 under which it is planned. They averred that the merger would vitiate their guarantee of 8 per cent annual dividends on their stock as set forth in the 999-year lease of the power company. The defendant companies contended that the future water-power development of the state was dependent upon the merger.

Water Rights of Utah Power & Light Company Affirmed.—A decision has been rendered in the District Court at Logan, Utah, in the case of the Logan, Hyde Park & Smithfield Canal Company and other water users vs. Logan City, in which suit the Utah Power & Light Company, at the request of Logan City, was made a cross-defendant. The decision in substance confirms a supplemental right of the Utah Power & Light Company to divert and use for power purposes 125 sec.-ft. of the waters of Logan River and decrees that whatever right Logan City has to impound, divert or use the waters of Logan River for power purposes is subsequent and subordinate to the rights of the plaintiffs and the cross-defendant. Suit was brought to restrain the city from storing water in its dam above the normal level and to compel it to confine the flow through the wheels of its power plant to the natural flow available in the river. The city is enjoined and restrained from so operating its diverting works and power plant on Logan River as to impede in any manner the free and natural flow of the waters of the river, to which the plaintiffs and cross-defendant are entitled.

Oklahoma Commission's Right to Change Franchise Rates Sustained.—Reversing a judgment granted to the city of Duncan, Okla., against the Western Oklahoma Gas & Fuel Company because of permission granted by the Oklahoma Corporation Commission to the company to charge for service that was by its franchise to be rendered freely, the Supreme Court of Oklahoma said: "While it appears to be unjust for a corporation or an individual to obtain a valuable right from a municipality to use its streets and alleys, to establish its plant therein and, as a consideration therefor, it is agreed (*sic*), and the solemn agreement is written into the franchise, and, after the corporation or individual has established its plant, then it is permitted to repudiate the agreement, yet the courts have justified the cancellation of the agreement upon the ground that the municipality is but an arm of the state, and, in a case where public utilities are performing services to the public, the state in the exercise of its sovereign power has the right to regulate the charges and rates therefor, and in all the late decisions with regard to the question of rates to be charged by water companies or heat, light and power companies the state or its Corporation Commission has the right to change, modify or amend any provision looking toward furnishing free water, gas, light or power." (251 Pac. 37.)*

Commission Rulings

Reasonable Return Should Be Assured on Extension Involving Large Outlay.—The fact that the Central Maine Power Company is authorized to furnish service to and has charter rights within Round Pond, a community demanding electric service, did not, according to the Public Utilities Commission of Maine, require that an extension should be made without a guarantee of revenue for a reasonable length of time, since the extension would require a comparatively large capital outlay. On requiring the company to make an extension at a cost of $11,856 to serve this town the commission therefore held that it was reasonable to require a guarantee of a yearly minimum gross operating revenue of $2,500 for five years.

Determination of Accrued Depreciation.—The Wisconsin Railroad Commission refused to accept a determination of accrued depreciation of the electric plant at Chippewa Falls arrived at by an engineer making an inspection of the property and selecting all items which in his opinion would have to be replaced within five years and applying to these items the unit prices used in the company's valuation. This method, the commission said, had the following fundamental defects: "First, the selection of a five-year period is entirely arbitrary; there does not seem to be any logical reason why five years should be used rather than three years or ten years, though the results of the adoption of a different period would differ widely from those found. Second, by this method the property to be replaced during the next five years is considered as in zero condition at this time, which is a supposition clearly contrary to fact. Third, the remainder of the property is considered as being in 100 per cent condition, which is also clearly contrary to fact. Let us suppose that a large amount of the property was in such a condition that at the end of six or seven years it would require replacement. This method would in no way reveal this condition."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Financial and Corporate

Bonds Feature Utility Markets
Stocks Inactive but Firm
Money Continues Easy

THE ELECTRICAL WORLD'S index of ten active power and light bonds has risen steadily since the first of the year, having gained five points during the past year, standing today at 102. Although considerably above levels anticipated a few months ago, utility bonds still tend upward. Bond market levels in general are today at the highest point in nearly fifteen years, and utility bonds have contributed their share.

Reasons cited for the unusual strength and activity of the bond market include the abundance of investment funds at low rates, the large seasonal investment demand and the current uncertainty in the stock markets. For the most part, the issues that have been most widely traded in include those just under the gilt-edged class. Discount bonds have made a larger gain in 1926 than those at a premium, though both of them have been active.

Power and light stocks for the most part have continued to withstand the bear activity in industrial issues. No wide changes have taken place during the week among common issues. The average of fifteen active common stocks stands at 94, the same average as last week, against 95 a year ago. Small gains were made by American Gas & Electric and Middle West Utilities. Slight losses were recorded in five of these issues and the other eight remained unchanged.

Preferred issues are extremely quiet at the moment, owing partly to the large volume of new issues coming into the market.

Company Reports

Name of Company	Gross Earnings Twelve Months Ended Dec. 31 1926	1925
Alabama Power	$13,168,892	$11,724,117
American Power & Light	*58,745,751	*50,627,689
American Wtr.Wks.& Elec.	45,399,463	41,055,905
Baton Rouge Electric	960,479	799,614
Binghamton Lt.,Ht.& Pwr.	1,929,812	1,679,165
Blackstone Valley Gas & Electric	5,528,770	5,067,741
Cape Breton Electric	612,630	567,914
Columbus Elec. & Pwr.	3,777,339	2,753,510
East Kootenay Power	†314,194	†288,770
East Texas Electric	*5,577,439	*3,260,818
Edison Electric Illuminating of Brockton	1,756,686	1,677,015
Electric Lt. & Pwr. Co. of Abington & Rockland	580,914	535,577
El Paso Electric	2,836,915	2,552,617
Florida Public Service	1,673,249	1,059,357
Galveston-Houston Elec.	4,589,081	3,938,944
Lowell Electric Light	1,728,755	1,620,530
Metropolitan Edison	9,587,181	8,675,747
New Jersey Pwr. & Lt.	2,419,506	1,390,789
North Carolina Pub. Serv.	2,096,533	1,860,027
Northern Ohio Power	12,040,840	11,499,698
Northern Texas Electric	2,524,333	2,458,273
Puget Sound Pwr. & Lt.	13,533,747	12,842,275
Savannah Electric & Pwr.	2,233,704	1,959,671
Sierra Pacific Electric	1,260,542	1,136,857
Tampa Electric	4,871,773	3,326,891

* Twelve months ended Nov. 30.
† Nine months ended Dec. 31.

Queens Borough Gas to Readjust Set-up.—A special meeting of stockholders of the Queens Borough Gas & Electric Company has been called to readjust capitalization of the company as follows: An increase in the authorized common stock from 20,000 shares (par value $100) to 500,000 no-par-value shares and in the preferred from 50,000 shares of a par value of $100 to 150,000 shares with the same par value. It is planned to reclassify the 24,500 shares of preferred which are now authorized and outstanding into series 8 per cent cumulative preferred stock, while the 25,500 shares of preferred which have previously been authorized but are not at present outstanding will be redesignated as series "A" 6 per cent cumulative preferred stock. Of the total increased preferred 50,000 shares will be made part of the series "A" 6 per cent cumulative preferred, while the remaining 50,000 shares will be cumulative preferred stock.

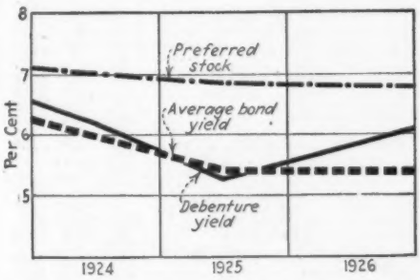
Customer Sales Reach $19,060,000 in November

Based upon monthly reports received by the ELECTRICAL WORLD from electric light and power companies selling stock direct to their customers and employees, it is estimated that during November a total of 265,000 shares were sold in this manner. The value of the stock sold is estimated at $19,060,000. A total of 38,900 customers took part in the sales during November.

Current Methods of Financing—I

Bonds Dominate New Issues—Nearly Billion and a Half of Capital Will Be Needed by the Power and Light Industry This Year

IN WHAT form the power and light industry will choose to raise its anticipated needs of nearly a billion and a half of capital during 1927 is a matter of conjecture. The source of this capital, however, is no longer a problem, thanks to the enviable record of the industry and the unprecedented volume of funds now available at low rates.



YIELD ON VARIOUS CLASSES OF SECURITIES IN PAST THREE YEARS

There are two or three significant indications of how these funds will be raised. Last year approximately 75 per cent of all new money secured was in the form of bonds and debentures, against about 53 per cent the year before. For the first month of the current year, out of a total of approximately $223,000,000, more than 82 per cent was secured in bonds and debentures. Furthermore, as already indicated, the market for bonds is very favorable. Bonds in general are at the highest level in nearly fifteen years. With cheap money in all the world's leading financial centers, there is no evidence at the moment of any near-future reversal of the rate trend. This background suggests even a larger proportion of obligations in 1927's financing than in that of 1926.

The utilities and their investors alike are concerned with the relative distribution of stocks, bonds and debentures in the raising of new capital. It would be enlightening to the investor at times to know why a particular type of security is sold in preference to some other. He knows that the cost of money is a prime consideration, but if this were the only factor, bonds would be sold exclusively. Some of the other things that must be considered are the building of a balanced capital set-up, the maintenance of a creditable junior dividend record and the assurance that the set-up will permit of further financing when necessary.

An analysis of the power and light industry as a whole shows a low proportion of debt in relation to earnings. Indebtedness could be greatly increased without involving any danger to the investor. At present there is less than $5 of debt in rel tion to each dollar of net earnings, while some investment authorities consider $10 debt per dollar of earnings a safe ratio. Experience has shown that bonded indebtedness may reach a very high figure so long as earnings guarantee the future success of the enterprise. A discretionary increase in the average of bonded indebtedness to a much higher point than that at present existing is feasible.

REFUNDING AND CUSTOMER SALES

Figures just revised show that refunding in 1926 required approximately $393,000,000. The advantages of refunding are still more pronounced than last year, and it is anticipated that this year's volume may be even greater. The issue of debentures, especially by

holding companies, to purchase the junior securities of subsidiaries, thus improving the position of the latter as well as their senior issues, is expected to continue on a large scale.

With regard to preferred-stock issues customer sales fell off last year, and there is nothing to indicate the probable trend beyond the fact that the market for such sales is widening to include investors in all occupations and circumstances. Customer sales last year amounted to 17 per cent of the total financing.

Specific examples of financing, pointing out the purpose and viewpoint of the originators, will follow.

Stockholders Oppose New Financing.—Stockholders of the Southern Cities Utilities Company have united in opposition to a plan recently proposed calling for the creation of 30,000 shares of prior preference stock of $3,000,000 par value in priority to the present preferred stock and 25,000 shares of junior preference stock of $1 par value to take precedence over the present class A and class B common stock. Certain stockholders have objected to the plan on the ground that the junior preference stock carries the same voting power as the present class A and class B common shares. Requests by stockholders for information with reference to certain stocks, dividends, etc., were met by a statement that information requested in good faith would be furnished.

Directors Vote Stock Increase.—Directors of the Bangor Hydro-Electric Company have voted to increase the common stock by 50,000 shares.

New Members Elected to Electric Refrigeration Board.—Harold V. Bozell of Bonbright & Company and B. A. McDonald, formerly president of the Commercial Credit Company of Chicago, have been elected directors of the Electric Refrigeration Corporation. Mr. McDonald was elected vice-president and treasurer of the Electric Refrigeration Corporation and also president of the Refrigeration Discount Corporation, which will handle time-payment sales of the Kelvinator, Nizer and Leonard divisions. The directors have decided to omit the customary quarterly stock dividend of 1¼ per cent, but have declared the regular quarterly cash dividend of 50 cents a share, payable Feb. 21 to holders of record Jan. 31.

New Capital Issues

With the purpose of retiring its existing funded indebtedness the Community Power & Light Company issued first mortgage collateral gold bonds to the amount of $11,000,000 during the first week in February. These thirty-year 5 per cent bonds were priced at 95½ and accrued interest, to yield about 5.30 per cent.

Offering was made by the Lexington Utilities Company of first and refunding mortgage gold bonds to the amount of $3,750,000, the price being 96½ and accrued interest, to yield about 5.25 per cent. The proceeds from the sale of these bonds will be used to retire $3,037,950 principal amount of first lien and refunding 6 per cent gold bonds, to reimburse the company for additions and for other corporate purposes. Upon completion of this financing these bonds will be secured by direct first mortgage on a substantial portion of the property of the company.

The Rhode Island Public Service Company issued 500,000 shares of cumulative preferred stock without par value, the price being $30 per share and accrued dividends yielding 6.66 per cent.

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Feb. 1	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	*k* 81½	83*	87½*
Adirondack Pwr. & Lt.—7% pf.	106	101*	108½*
Adirondack Pwr. & Lt.—8% pf.	112	101*	115*
Ala. Pwr., 7% pf.	108½	....	....
Allis-Chalmers Mfg., 7% pf.	108½	110	111
Allis-Chalmers Mfg., 6% com.	90½	88	92½
Aluminum Co. of Amer., com.	70½	70½	72
Aluminum Co. of Amer., 6% of.	102	....	....
Amer. & Foreign Pwr., pf. 25% pd.	*m*110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	*k* 87½	87½	89½
Amer. & Foreign Pwr., com.—no par.	19½	10	23
Amer. Bosch Magneto, com.—no par	14½	13	17½
Amer. Brown Boveri Elec†	35½	35	39½
Amer. Brown Boveri Elec., pf. $7	98	96½	98
Amer. Gas & Elec., 6% pf.—no par	97½	96½	98
Amer. Gas & Elec., com.†—no par	71½	68½	100½
Amer. Lt. & Trac., 6% pf.	112	105	132
Amer. Lt. & Trac., com.†	230	224½	233
Amer. Pwr. & Lt., 6% pf.	98½	97½	98½
Amer. Pwr. & Lt., com.†—no par	58½	54	61½
Amer. Pub. Serv., 7% pf.	*k* 96	92*	97½*
Amer. Pub. Serv., com.†	50	45*	80*
Amer. Pub. Utilities, 7% pr. pf.	86	73*	89*
Amer. Pub. Utilities, 7% ptc. pf.	71	86*	95*
Amer. Pub. Utilities, com	*m*66	68*	82*
Amer. States Sec., A	3½	2*	9½*
Amer. States Sec., B	4½	1½*	5½*
Amer. Superpwr., $6 pf.—25	28½	26½	28½
Amer. Superpwr., 7% pf.	*l* 94½	....	....
Amer. Superpwr., Class A†—no par.	29½	28½	29½
Amer. Superpwr., Class B†—no par.	30	28½	30
Amer. Wtr. Wks. & Elec., 7% pf.	*k*108½	105½	110½
Amer. W. W. & E., com. $1.20—20	65½	62½	67½
Anaconda Copper Cap. $3	47½	46½	49½
Appalachian Electric Pwr., 7% pf.	*k* 99	90*	101*
Appalachian Elec. Pwr., 2d pf., 7%	98	99*	102*
Appalachian Elec. Pwr., com.	*m*78	....	....
Arizona Pwr., 7% pf.	79	60*	82*
Arizona Pwr., com.	23	....	....
Arkansas Cent. Pwr., pf.—$7 no par.	*k*101	99*	107*
Arkansas Lt. & Pwr., 7% pf.	103	96*	104*
Arkansas Lt. & Pwr., com.	100	110*	115*
Assoc. Gas & Elec., $3.50—50	51	....	....
Assoc. Gas & Elec., pf.—$6—no par	86½	79½*	86½*
Assoc. G. & E., Class A, $2.50—no par	38½	35	38½
BABCOCK & WILCOX, 7% com.	117	117*	151*
Binghamton L., H. & P., $6 pf.	91	90*	95*
Birmingham Elec., pf.—$7—no par.	105½	101*	108*†
Blackstone Valley G. & E., $6 pf.	102	103*	106*
Blackstone Valley Gas & Elec., 10% com.—50	*k*105	100½*	106*
Blaw-Knox, com.†	*t* 73	70	73
Brazilian Trac., Lt. & Pwr., com.†	*fl*15½	....	....
Broad River Pwr., 7% pf.	95	93*	98*
Brooklyn Edison, 8% com.	151½	149½	154½
Buffalo, Niagara & East. Pwr., pf.—25	*k* 24	....	....
Buffalo, Niagara & East. Pwr., com.†—no par	*k* 28	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	94	89*	95*
California Ry. & Pwr., 7% pf.	105	88*	130*
Carolina Pwr. & Lt., pf.—$7—no par	*l*107½	107½	108
Central & S.W. Util., 7% pf.—no par	*a* 96½	93½	96½
Central & S.W. Util., pr. ln. $7 pf.—no par	*a*101½	98½	101½
Central Ariz. Lt. & Pwr., 7% pf.	94	....	....
Central Ark. Ry. & Lt., 7% pf.	101	99*	101*
Central Ill. Pub. Serv., 6% pf.	*k* 86	89*	91*
Central Ind. Pwr., 7% pf.	86	84½*	93½*
Central Pwr. Lt., 7% pf.	100	94*	103½*
Central States Elec., 7% pf.	*k* 90½	91*	97*
Central States Elec., com.†	*m*200	200*	230*
Century Elec., 6% com.	*m*117	110*	117*
Chicago Fuse Mfg., com.—$2.50 no par	*a* 30	30	30
Cincinnati Gas & Elec., 5% com.	*g* 94	93½	95½
Cities Service, 6% pf.	*l* 91½	91½	92½
Cities Service, pf. B—10	*l* 8½	8½	8½
Cities Service, pf. BB—100	*l* 82	82	82½
Cities Service, com.—20	*l* 55½	50½	55½
Cities Service, Bks. Shrs.—10	*l* 27	25	27
Clarion River Pwr., 8% pf.	95	93*	95*
Cleveland Elec. Illg., 6% pf.	108	103*	109*
Cleveland Elec. Illg., 10% com.	300	240*	310*
Colorado Pwr., 7% pf.	*k* 95	96*	97*
Columbia Gas & Elec., 6% pf.	100½	98½	101½
Columbia G. & E. com. $2.60—no par	85½	43½	91½
Columbia Ry., Gas & Elec., 6% pf.	94	65*	96*
Columbus Elec. & Pwr., 2d. pf.	103	....	....
Columbus Elec. & Pwr., 9% com.	55	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf.	98	98*	99½*
Columbus Ry., Pwr. & Lt., 6½% pf. B	97½	92*	97*†
Columbus Ry., P. & L., com.—no par	70	70*	85*
Commonwealth Edison, 8% com.	*a*140	138	141
Commonwealth Pwr., 6% pf.	92	91½	93½
Commonw'th Pwr., $2, com.—no par	44½	42½	45
Conn. Lt. & Pwr., 8% pf.	118	117*	121*†
Conn. Lt. & Pwr., 7% pf.	112	108*	113*
Cons. Gas of N. Y., pf.†—50	55½	57*	62½*
Cons. Gas of N. Y., com $5—no par.	99½	99½	109½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	*k*105	102*	107*
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	*k*110	107*	112*
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	*k*111	109*	115*
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	*e*126½	124*	128½*
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $2.50—no par.	*e* 51½	45*	57½*
Consolidated Pwr. & Lt., 7% pf.	106	100*	107*
Consumers Pwr., 6% pf.	99	95*	101½*
Consumers Pwr., 6.6% pf.	104	101½*	106*
Continental Gas & Elec., 7% ptc. pf.	104	96*	109½*
Continental Gas & Elec., 7% pr. pf.	100½	95½*	101½*
Conti. G. & E. com. $4.40—no par.	*k*210	85*	210*
Crocker Wheeler, com.†	31	26	31
Crocker Wheeler, 7% pf.	77	50*	70*
DALLAS PWR. & LT., 7% pf.	104½	102*	110*
Dayton Pwr. & Lt., 6% pf.	101	95*	100*
Detroit Edison, 8% com.	135½	133½	136½
Dubilier Condenser, com.—no par.	*k* 3½	3½	4
Dubuque Elec., 6% pf.	98	93*	98½*
Duquesne Lt., 7% pf.	*k*115½	115½	116½
EASTERN NEW YORK UTIL., $7 pf.	102	80*	104*
Eastern New York Util. com.	65	70*	75*
Eastern States Pwr., $7, com.	11	12*	32½*
Eastern States Pwr., pf.	92	89*	95*
East. Tex. Elec., 7% pf.	105	100*	107*
East. Tex. Elec., com. $5—no par.	75	70*	80*
Edison Elec. of Boston, 12% com.	*d*220	218½	229½
El Paso Elec., com. $5—no par.	70	70*	94*
El Paso Elec., 7% pf.	102	102*	106½*
Elec. Bond & Share, 6% pf.	*l*107½	107½	109
Elec. Bd. & Sh. Sec., com. $1—no par	*l* 68	70	70½
Electric Household Util.†	*a* 12½	11	14½
Elec. Investors, 6% pf.—no par.	92½	87*	95*
Elec. Investors, com.†—no par.	34½	33	37
Elec. Investors, 10% pd. receipts.	20	12*	56*
Elec. Pwr. & Lt., ctfs. pf.	96½	96	96½
Elec. Pwr. & Lt., ctfs., 40% pd.	103½	103½	104½
Elec. Pwr. & Lt., ctfs, full pd.	*k*103½	102½*	110½
Elec. Pwr. & Lt., ctfs., com.—no par.	17	16½	18½
Elec. Refrig. cap.†	36½	32½	37½
Elec. Ry. Securities, com.—no par.	*m* 8	....	....
Elec. St. Battery com. $5.25—no par	*k* 75½	73½	79½
Elmira Wtr., Lt. & R.R., 7% pf.	100	97½*	101½*
Emerson Elec., pf.	*m*105	101*	105*
Empire Pwr., A $6	25½	26½	27½
Engr. Pub. Serv., $7 pf.—no par.	99	93*	99
Engr. Pub. Serv., com. $7—no par.	24½	21½	24½
Eureka Vacuum Cleaner, com. $4—no par.	63½	60½	67½
FAIRBANKS MORSE, 7% pf.	*k*108	108	108½
F.-M., com.—$2.60—no par.	40½	39½	42½
Federal Lt. & Trac., com.†	39½	37½	42½
Federal Lt. & Trac., 5% pf.	92½	....	....
Ft. Worth Pwr. & Lt., 7% pf.	*l*108½	109	109
GALVESTON-HOUSTON ELEC. 6% pf.	67	65*	70*
Galveston-Houston Elec., com.	25	....	....
Gen. Elec., 8% com.	83½	81	85½
Gen. Elec., special—10	11½	11½	11½
Gen. Gas & Elec. (Del.) com. A. $1.50—no par	*k* 42	41	45
Gen. G. & E. (Del.) com. B—no par.	*m* 42	36*	48½*
Gen. G. & E. (Del.) pf. A. $8—no par.	*k*115½	115	115½
Gen. G. & E. (Del.) pf. A $7—no par.	103	100	107½
Gen G. & E. (Del.) pf. B$7	98½	96	98½
Gen. Pub. Serv., $7 pf.	*k*103	102*	106*
Gen. Pub. Serv., com.	13½	11½	13½
Ga. Lt., Pwr. & Rys., 6% pf.	89	82*	98*
Ga. Lt., Pwr., & Rys., com.	*m* 60	65*	80*
Ga. Ry. & Pwr., 8% pf.	*k*118	112*	122*
Ga. Ry. & Pwr., 7% pf.	105½	100½*	108½*
Ga. Ry. & Pwr., 4% pf.	*m*119	....	....
Ga. Ry. & Pwr., 4% com.	120	....	....
Gt. Western Pwr., 7% pf.	*h*104	....	....
IDAHO PWR., 7% pf.	103½	103*	106*
Ill. No. Utilities, 6% pf.	*k* 88	88*	92*
Ill. Pwr. & Lt., 7% pf.	98½	96½	100½
Ingersoll Rand com. $8	*k* 93	92	95½
Int. Combus. Engr., com. $2—no par	47½	43½	49½
Int. Util., Class A—$3.50—no par.	30½	28	31
Int. Utilities, Class B—no par.	4½	3	5½
Interstate Pwr., pf.—$7—no par.	92½	90*	98*
Interstate Pub. Serv., 7% pf.	98	96½*	99½*
Iowa Ry. & Lt., 7% pf.	96	98*	100*
JERSEY CENTRAL PWR. & LT., 7% pf.	97½	94*	98½*
Jersey Cent. Pwr. & Lt., 7% pfc. pf.	110	95½*	112*
Jersey Cen. Pwr. & Lt., com.—no par	*k* 25	25*	50*
Johns-Manville, com.†—no par.	60½	55½	66

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Franisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Jan. 29. *l*Bid price Wednesday, Feb. 2. *m*Latest quotations available. *1926. †Dividend rate variable.

Preferred Stockholders Receive Additional Rights.—Holders of the 6 per cent, 7 per cent and 8 per cent preferred stocks of the Public Service Corporation of New Jersey of record Feb. 5 will be offered the right to subscribe at $100 per share to 6 per cent cumulative preferred stock to the extent of one share for each five shares held. The right to subscribe to this stock will expire March 1.

Arizona Utility Calls Preferred Stock.—All of the 8 per cent preferred stock of the Central Arizona Light & Power Company has been called for redemption Feb. 1 at 110 and accrued dividends of $2 a share. The stockholders, instead of accepting cash, may exchange their shares for an equal amount of new 7 per cent no-par voting preferred plus $16 in cash. They may also purchase additional 7 per cent preferred at $98 a share on a share-for-share basis.

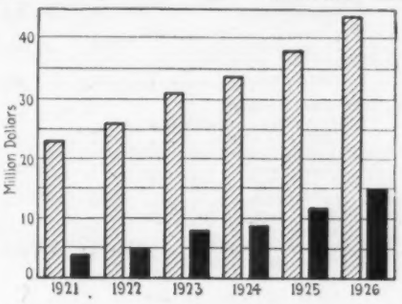
Detroit Edison Gross up 15 per Cent

Output and Net Earnings Each up 17 per Cent—Revenue per Customer $91 Against $86 Last Year

A SUBSTANTIAL reduction in the residence rate of the Detroit Edison Company, affecting more than 400,000 customers, failed to counteract the large growth in earnings during the year. Despite the reduction, net income was up nearly 17 per cent. The same figure represents also the increase in power generated.

Analyzing the financial set-up of the company in comparison with previous years, there are few changes. Indebtedness is a larger proportion of total capital, but only marginally. This reduces the ratio between gross earnings and funded debt from 54 to 52. Investment is 104 per cent of capital against 100 per cent at the end of 1925.

In growth of earnings Detroit Edison is making more progress than the industry as a whole. There were few material changes during the year in the earnings position. As already stated,



GROWTH IN GROSS AND NET EARNINGS OVER PAST SIX YEARS

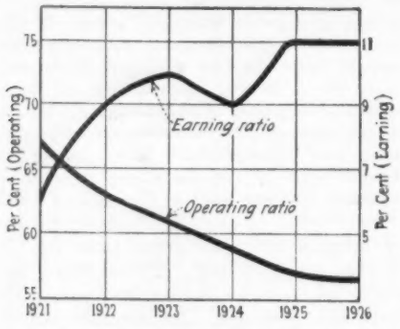
Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Feb. 1	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	k112¼	112¼	114¼
Kansas Gas & Elec., 7% pf.	l103½	103	103½
Kentucky Hydro-Elec., 7% pf.	a 96	94½	96
Kentucky Sec..6% pf.	82	75*	85*
Kentucky Sec., 5% com.	107	90*	108*
Kentucky Utilities, 6% pf.	l 95½	90*	96½*
Keystone Pwr. & Lt., 7% pf.	k97	95*	98½*
LACLEDE GAS LT., 8% com.	180	173½	180
Lehigh Pwr. Sec., com.—no par.	16½	15½	18
Long Island Ltg., 7% pf.	108½	107½	109
Long Island Ltg., com. $2—no par.	145	120*	150*
Los Angeles Gas & Elec., 6% pf.	98½	95½*	100*
Louisville Gas & Elec., cl. A. $1.75	24½	23½	25
MAN. ELEC. SUPPLY, cap. $4.25—no par.	55	53½	57½
Manila Elec., com.†—no par.	k 41½	40	43½
Maytag Mfg., com. .50—no par.	27½	23½	27½
Memphis P. & L., pf.—$7—no par	107½	103*	110*
Metropolitan Ed., pf.—$6—no par.	95	91½*	98*
Metropolitan Ed., pf.—$7—no par.	103½	102*	108*
Metropolitan Ed., com. $5—no par.	60	45*	60*
Middle West Utilities, 7% pf.	a107½	105½	107½
Middle West Util., 7% pr. lien pf.	a118½	117½	118½
Middle West Util., com. $6—no par	a112	110	113½
Midland Utilities, pr. ln. 7% pf.	a 98	98	98½
Midland Utilities, 7% pf. A	a 97	97	98
Milwaukee Elec. Ry. & Lt., 7% pf.	k101	100*	103*
Milwaukee Elec. Ry. & Lt., 6% pf.	k 98	87*	100*
Minn. Pwr. & Lt., 7% pf.	l104½	100	106
Miss. Pwr. & Lt., $8 pf.	107	102*	107½*
Miss. River Pwr., 6% pf.	94	93*	96*
Miss. River Pwr., com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.	102	....	....
Mohawk Hudson Pwr., 2d pf.—$7—no par.	100	90*	102*
Mohawk Hudson Pwr., com.—no par	23½	20½	23½
Montana Pwr., 7% pf.	m118½	118½	118½
Montana Pwr., 4% com.	82½	81½	83½
Montreal Pwr., 7% com.	f 70½	....	....
Mountain States Pwr., 7% pf.	96	97*	102
Mountain States pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	98	93*	101*
National Carbon, 8% pf.	m130	124*	130*
National Elec. Pwr., A†	25	23½	25½
National Elec. Pwr., 7% pf.	a 95½	93½	95½
National Lt., Ht. & Pwr., com.	24	22*	25*
National, Light, Ht. & Pwr., 5% pf.	70	71*	73*
National Pwr. & Lt., pf.—$7—no par	102	101½	103
National Pwr. & Lt., com.†—no par.	20½	19½	22
National Pub. Serv., 7% pf.	a 93½	87½*	95*
National Pub. Serv., 7% ptc., pf.	l10½	96*	112*
National Pub. Serv., A com. $1.60—no par.	20½	18½	21½
National Pub. Serv., B com.—no par	k 14	14	16½
Nebraska Pwr., 7% pf.	l107½	107½	108½
Nevada-Calif. Elec., com.	m 26½	18½*	44½*
New Brunswick Pwr., 7% pf.	58	30*	60*
New Eng. Pub. Serv., pr. ln. pf. $7..	98	98*	101
New Eng. Pub. Serv., pf. $7	93	95½*	97*
New Orleans Pub. Serv.—7% pf.	103	100*	105*
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	90	89*	95*
N. Y. Central Elec., 7% pf.	101	98*	100*
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	98*	112*
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	98*	114*
Niagara Falls Pwr., 7% pf.—25.	28	27½	29
Niagara, Lock. & Ont. Pwr., 7% pf.	111	110*	111½*
No. Amer., 6% pf.—50.	50½	50	51½
No. Amer., com.—10.	47	45½	49½
No. Amer. Edison, $6 pf.—no par.	98½	96½	100½
No. Caro. Pub. Serv., pf.—$7—no par	94	89*	96*
Northeastern Pwr., com.	17	16½	18½
No. Indiana Gas & Elec., 7% pf. A	101½	98*	103½*
No. N. Y. Utilities, 7% pf.	104	103*	105½*
No. Ohio Pwr., com.—no par.	11½	9½	12½
No. Ohio Trac. & Lt., 6% pf.	76	78*	81*
No. Ohio Trac. & Lt., 7% pf.	90	88*	96*
No. Ont. Lt. & Pwr., 6% pf.	k 87	75*	88½*
No. Ont. Lt. & Pwr., 4% com.	74	73*	78*
No. States Pwr., 7% pf.	101½	100½	101½
No. States Pwr., 8% com.	111	109½	111½
No. Texas Elec., 6% pf.	58	48*	65*
No. Texas Elec., 4% com.	31	27	31
OHIO BRASS, com. B $4—no par.	76	70*	80*
Ohio Brass, 6% pf.	100	98*	101*
Ohio Gas & Elec., 7% pf.	94	90*	95*
Ohio Pwr., 6% pf.	98	90*	97*
Ohio Pub. Serv., 6% pf.	95	94½	95
Ohio Pub. Serv., 7% pf.	l105	103½	105
Ohio River Edison, 7% pf.	102½	98½*	105*
Oklahoma Gas & Elec., pf.	96	....	....
PACIFIC GAS & ELEC., 6% pf.	25	....	....
Pacific Gas & Elec., 8% new com.	32½	32	33
Pacific Pwr. & Lt., 7% pf.	l102½	102½	102½
Parr Shoals Pwr., 6% pf.	92	90*	97½*
Penn Cent. Lt. & Pwr., $5 pf.—no par.	c 72	71½	72½
Penn-Ohio Edison, 7% pf.	98	....	....
Penn-Ohio Elec., 7% pf.	95	93*	96*
Penn-Ohio Pwr. & Lt., 7% pf.	98	94*	100*
Penn-Ohio Pwr. & Lt., 8% pf.	109	100*	111*
Penn Pwr. & Lt.—$7—no par	l108	105½	106½
Penn Pub. Serv., 6% pf.	87	85*	90*
Penn Wtr. & Pwr., 8% com.	m178	140*	180*
Phila. Co., 6% pf.—50.	50½	50	51
Phila. Co., com.—50.	k 86½	85½	88
Phila. Elec., 8% com.—25.	c 49½	49½	54
Pittsburgh Utilities, 7% pf.—10.	m19½	14½*	20½*
Portland Elec. Pwr., 7% pf.	97½	97*	101*
Portland Elec. Pwr., 6% pf.	84	71*	87*
Portland Elec. Pwr., 6% 2d pf.	68	71*	75*
Portland Elec. Pwr., com.	29	26*	48*
Potomac Elec. Pwr., pf.	l109	....	....
Pwr. Corp. of N. Y., com. $1—no par	m79	77½*	90½*
Pwr. Sec., pf.—no par.	k 37	10*	39*
Pwr. Sec., com.—no par.	k 5	4*	13*
Public Serv. of Colorado, 7% pf.	l 99	99	99
Pub. Serv. of N. J., 7% pf.	k109½	108½	110½
Pub. Serv. of N. J., 8% pf.	k126	125	126
P. S. of N. J., $5 com.—no par.	33½	32	35
Pub. Serv. of No. Ill., 6% pf.	a104	102	104
Public Serv. of No. Ill., 7% pf.	a113½	113½	114
P. S. of No. Ill., com. $8—no par.	a132½	130½	133
Pub. Serv. of No. Ill., 8% com.	a132½	132	133
Pub. Serv. of Okla., 7% pf.	99	92*	100*
Pub. Serv. Elec. & Gas, 6% pf.	103½	102	103½
Pub. Serv. Elec. Pwr., 7% pf.	k114½	113½	114½
Puget Sound Pwr. & Lt., 7% pf.	102	103*	108*
Puget Sound Pwr. & Lt., 6% pf.	82	82*	84½*
Puget Sound Pwr. & Lt., com.	32½	30½	33½
RADIO CORP. OF AMER., pf.—50.	50½	50½	52
Radio Corp. of Amer., com.—no par.	52½	47½	54½
Republic Ry. & Lt., pf.	k115	95*	120*
Republic Ry. & Lt., com.	120	75*	116*
Rochester Gas & Elec., pf. B.	105½	....	....
Rochester Gas & Elec. Ser. D, pf. C.	102½	....	....
Rochester Gas & Elec., 7% pf.	106	105*	107*
SAFETY CABLE, com. $4.	55½	52½	56½
San Joaquin Lt. & Pwr., 7% pf.	106	97½*	108*
St. Joseph Ry., L., H. & P., 5% pf.	70	60*	70*
Servel Corp.	9½	7½	9½
Sierra Pacific Elec., com.	24	26½	27½
Sioux City Gas & Elec., 7% pf.	100	96*	101½*
Southeastern Pwr. & Lt., pf.—$7 no par.	k101½	97*	103*
Southeastern Pwr. & Lt., $6 ptc. pf.	k 67½	67½	68
Southeastern Pwr. & Lt., com.—no par.	30½	30	32½
So. Calif. Edison, 8% pf.	36½	32½*	36*
So. Calif. Edison, 7% pf.	27	....	....
So. Calif. Edison, 6% pf.	24	....	....
So. Calif. Edison, 8% com.	m 33½	31½	34½
Southern Cities Utilities, 7% pf.	79	....	....
Southern Cities Utilities, com. $4.	23	....	....
Southwestern Lt. & Pwr., A $3.	63	52*	60*
Southwestern Lt. & Pwr., B.	63	38*	58*
Southwestern Lt. & Pwr., $6 pf.	85	75*	82*
Southwestern Pwr. & Lt., 7% pf.	k104	100*	105*
Springfield (Mo.) Ry. & Lt., 7% pf.	97	95*	100*
Standard Gas & Elec., 8% pf.	58	57½	58½
Standard Gas & Elec., 7% pf.	104½	104½	106
Standard G. & E., com. $3—no par.	54½	54	55½
Standard Pwr. & Lt., 7% pf.	96	90*	98½*
Staten Island Edison, pf.—$6—no par.	100	93*	97½*
Superheater, $6 com.—no par.	167	138*	173*
Syracuse Lighting, 7% pf.	102	105*	107*
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, 8% com.	300	260*	355*
TAMPA ELEC., com. $2.	62½	49	62½
Tenn. Elec. Pwr., 6% pf.	92	87*	90*
Tenn. Elec. Pwr., 7% pf.	102	98*	105*
Terre Haute, Ind. & East. Trac., 5% pf.	20	20*	37*
Terre Haute, Ind. & East. Trac., com	1	1*	7*
Tex. Pwr. & Lt., 7% pf.	l106½	107	109
Tide Water Pwr., 8% pf.	105	101*	106*
Timken Roller Bear., com.—$4 no par.	90½	78	93
Toledo Edison, 8% pf.	l115	114	115
Toledo Edison, 7% pf.	l105	104	105
Toledo Edison, 6% pf.	l 95	94½	95
Toledo Edison, 6% com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	90	87½*	90*
UNITED GAS & ELEC., 6% pf.	98	94*	97*
United Gas & Elec., com.—no par.	m57	56*	66*
United Gas & Elec. (N. J.) 5% pf.	67	70*	75*
United Gas Impr., 8% com.—50.	c 89½	89½	93½
United Lt. & Pwr., pf.—$4—no par.	50½	50½	50½
United Lt. & Pwr., pf.—$6.50—no par.	87	81*	91*
United L. & P., com. A .48—no par.	14½	13½	15½
United L. & P., com. B .48—no par.	k 16½	14	16½
Utah Pwr. & Lt., 7% pf.	l104½	103½	104½
Utica Gas & Elec., 7% pf.	105	103*	106*
Utica Gas & Elec., 8% com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	93	92*	98*
Utilities Pwr. & Lt., com. A $2.	27½	27	29½
Utilities Pwr. & Lt., com. B $1—no par.	14½	13½	14½
VERMONT HYDRO-ELEC., 7% pf.	96	94*	96*
Virginia Elec. & Pwr., 7% pf.	104	101*	105*
Virginian Pwr., 7% pf.	108	102*	104*
Virginian Pwr., com.	70	65*	75*
WAGNER ELEC., 7% pf.	b 72	70	74
Wagner Elec., com.†—no par.	b 23½	18½	24
Washington Ry. & Elec., 5% com.	j180	....	....
Washington Ry. & Elec., 5% pf.	j 90½	....	....
Washington Wtr. Pwr., 8% com.	136	130*	138*
West Mo. Pwr., 7% pf.	m92	....	....
West Penn Elec., 7% pf.	k107½	102	107½
West Penn Elec., Cl. A $7.	k101	97½	102
West Penn Pwr., 7% pf.	k112	111	114
West Penn Pwr., 6% pf.	m102½	100½	103
West Virginia Lt., Ht. & Pwr., 7% pf.	94½	95*	98*
West Va. Utilities, 7% pf.—50.	48½	43*	51*
Western Pwr., 7% pf.	97	....	....
Western States Gas & Elec., 7% pf.	92	89*	94½*
Western States Gas & Elec., com.	16	....	....
Westinghouse Elec. & Mfg., 8% com.—50.	69½	67½	70½
Weston Elec. Instrument, Cl. A $2.01—no par.	32½	30½	34½
Weston Elec. Instrument, com.—no par.	16½	15	17½
Wheeling Elec., 6% pf.	95	91*	97*
Wis. Pwr., Lt. & Ht., 7% pf.	k 95	85*	91*
Worthington Pump, 7% pf. A	k 44	46	48½
Worthington Pump, 6% B.	k 39	40½	42½
Worthington Pump, com.	21½	20½	24
YALE & TOWNE com. $5—25.	k 72	70½	72½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Jan. 29. *l*Bid price Wednesday, Feb. 2. *m*Latest quotations available. *1926. †Dividend rate variable.

gross is up 15 and net 17 per cent. This does not vary greatly from the increase made during the previous year. Bond interest is earned four and a half times against four and a fifth, despite the debt increase. The operating ratio is about the same as that of 1925, and the earnings ratio also increased fractionally. Revenue remains at 21



EARNING AND OPERATING RATIOS OF DETROIT EDISON COMPANY

per cent of total assets, and net earnings before depreciation continue at 43 per cent of revenue.

The progress of the company's business is at about the same rate of growth as last year. This year's output for the first time exceeded two billion dollars. This is at a rate of 45 kw.-hr. per dollar of gross revenue. Kilowatt-hours sold per customer increased from 3,806 in 1925 to 4,104 last year, and the revenue per customer grew from $86 to $91.

Net additions to investment in 1926 amounted to $29,952,801 against $18,577,146 the year before. A balance of $14,078,828 in retirement reserve at the end of 1926 seems ample to take care of retirements expected in the next few years. This fund is increased "when and as it is timely to do so" rather than by a yearly increment.

A feature pointed out in the company's report is the increase in the already large percentage of taxes paid. Last year 9.03 per cent of gross earnings was taken in taxes against 8.04 per cent the year before.

The rate reduction already referred to brought the first "block" of service from 12 cents to 10 cents per kilowatt-hour, and it is further reduced to 9 cents net by the discount allowed for prompt payment of bills.

SET-UP, EARNINGS AND FINANCIAL POSITION OF DETROIT EDISON COMPANY

	1926	1925
1. Financial Set-up:		
Per cent debt to capitalization	49	47
Per cent gross revenue to capitalization	25	25
Per cent gross to funded debt	52	54
Per cent investment to capitalization	104	100
Per cent gross to investment	42	39
2. Revenue Record:		
Per cent operating costs to gross	57	56
Per cent revenue to total assets	21	21
Per cent net earnings* to revenue	43	43
Times bond interest earned	4½	4½
Dividend earned	$11.32	$10.68
Earnings compared with whole industry—Exceed growth of industry.		
3. Trust Investment Tests:		
Per cent debt to book value of property	21	21
Per cent increase in gross	15	14
Is mortgage modern? Open-end — modern type.		
4. Business Progress:		
Kw.-hr. output per dollar gross	45	45
Kw.-hr. sold per customer	4,104	3,806
Per cent increase in output	17	18
Revenue per customer	$91	$86

*Before depreciation.

Community Power & Light Plans Delaware Charter.—A meeting of the stockholders of the Community Power & Light Company has been called for Feb. 8 to act on a recommendation of its directors that assets of the present company, which is incorporated in Illinois, be transferred to a company of the same name incorporated in Delaware. Stocks in the new and old companies would be exchanged share for share.

Security Issues of Electric Service Companies in January

Name of Company	Amount of Issue	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Electric Bond & Share Co.	$15,000,000	..	Cumulative preferred stock	General corporate purposes of the company in expanding its business.	6	107½	5.58
Florida Power & Light Co.	7,000,000	..	Cumulative preferred stock.	Construction.	7	100	7
Southern California Edison Co.	15,000,000	25	Refunding mortgage gold bonds	Extensions to the properties of the company, and to retire bonds.	5	98½	5.10
Central Arizona Light & Power Co.	1,300,000	20	First and refunding mortgage gold bonds, series C.	To reimburse company for expenditures made for additions to property and for other corporate purposes.	5½	100	5.50
General Power & Light Co.	750,000	1	Gold notes.	To pay in part for acquisition of additional properties and for other corporate purposes.	6	100	6
People's Light & Power Corp.	6,500,000	14	First lien gold bonds.	Acquisition of properties.	5½	97	5.80
	5,000,000	35	Convertible gold debentures.		6	98	6.15
Louisiana Ice & Utilities Inc.	500,000	20	First mortgage gold bonds convertible, series A.	To provide funds for acquisition of properties, for betterments and extensions, and for other corporate purposes.	6	98	6.20
Interstate Gas & Electric Co.	625,000	25	First lien collateral and refunding gold bonds, series A.	To purchase securities and for other corporate purposes.	6	100	6
Florida Public Service Co.	1,634,000	29	First mortgage gold bonds, series B.	.....	6	100	6
San Joaquin Light & Power Corp.	25,000,000	30	Unifying and refunding mortgage gold bonds, series D.	To retire all bonds and to reimburse company's treasury for expenditures for additions, extensions and improvements.	5	98½	5.10
Indianapolis Power & Light Co.	30,000,000	30	First mortgage gold bonds, series A.	Acquisition of properties	5	98	5.13
	12,000,000		Cumulative preferred stock.		6½	98	6.63
Southwestern Gas & Electric Co.	12,500,000	..	First mortgage gold bonds, series A.	To redeem bonds for acquisition of property, to reimburse for expenditures on additions and for other corporate purposes.	5	96	5.25
Central Hudson Gas & Electric Corp.	8,000,000	30	First and refunding mortgage gold bonds.	To retire bonds of companies recently acquired and for additions and improvements made to properties.	5	101½	4.90
Pennsylvania-Ohio Edison Co.	1,500,000	..	Cumulative prior preference stock.	To reimburse for expenditures for additions to plants and properties of subsidiaries.	7	99	7.07
Tide Water Power Corp.	2,000,000	3	First lien and refunding mortgage gold bonds, series C	To reimburse for expenditures made and for expenditures to be made for construction.	5	98½	5.54
South Carolina Power Co.	4,000,000	30	First lien and refunding mortgage gold bonds.	.....	5	95	5.33
Cities Service Co.	250,000 shares		.....	Common stock.	..	....	8
American Commonwealths Power Corp.	3,500,000	25	Gold debentures, series A.	To acquire stock	6	95	6.40
New Orleans Public Service, Inc.	8,000,000	30	First and refunding mortgage gold bonds.	To reimburse for expenditures made for additions	5	96	5.25
Illinois Power & Light Corp.	9,500,000	30	Sinking-fund debenture gold bonds.	.....	5½	96½	5.75
Narragansett Co.	27,500,000	30	Collateral trust gold bonds, series A.	Acquisition of stock	5	99	5.06
National Public Service Corp.	2,000,000	..	Cumulative preferred stock, series A	To reimburse for additions to system and for additional working capital.	7	96	7.29
North American Edison Co.	25,000,000	30	Debentures, series A.	To redeem bonds and for other corporate purposes	5	98	5.12
Total	$223,859,000	..	.....	.....	..	....	....

Manufacturing and Markets

Use of Fractional-Horsepower Motors

Motor Manufacturers, Power Companies and Appliance Manufacturers Consider Performance and Application—Possible Restrictions in View

INCREASING use on lighting circuits of motor-driven appliances of such character as to require motors of relatively large capacity and serving such purposes that they are being operated more and more during the lighting hours has made it necessary for central-station companies to give serious consideration to the electrical characteristics of these motors and their effect upon customers' service and the companies' systems and investment.

At a conference last June between the Association of Edison Illuminating Companies, the National Electric Light Association and the fractional-horsepower motor manufacturers, details of which were published in the ELECTRICAL WORLD (July 3, 1926, page 43), the problems of improving the electrical characteristics of fractional horsepower motors was discussed. At that time it was planned to hold further conferences with appliance manufacturers to discuss ways and means of bringing about the more general use of fractional-horsepower motors of higher power factor and efficiency where such are justified, and on Jan. 26 encouraging progress was made at another informal conference of motor manufacturers, public utility representatives and appliance manufacturers held in Detroit.

As outlined by C. F. Hirshfeld of the Detroit Edison Company the purpose of this meeting was to lay before the appliance manufacturers the problems that confront the central-station companies and enlist the co-operation and assistance of the appliance and motor manufacturers in obtaining the use of motors with better and more efficient electrical characteristics in situations where such improved characteristics are justified. It is the desire of the power companies to furnish their customers with the best and most efficient devices in the belief that only by selling the maximum service at a minimum expenditure for energy consumed can an ever-increasing demand for the service be maintained. That the introduction of the high efficiency tungsten lamp had actually been the means of increasing the use of energy for lighting was cited as an instance of the effect of promoting the use of electrical equipment of maximum efficiency. Similarly the central-station industry is urging the use of the most efficient motors on electrical appliances which operate over sufficiently long periods of time to make the energy consumption significant.

Tests conducted during the past two years have demonstrated that many makes of the fractional horsepower motors now sold with such appliances have most undesirable electrical characteristics, requiring large starting currents, having low full-load efficiencies and operating at very low power factors. The existence of a few lines of such motors having much better characteristics and in actual use on similar appliances shows that it is commercially feasible to produce and sell a product much better adapted for operation on lighting circuits.

It is expected that appliances of the character in question, particularly refrigerating machines, oil burners, dishwashers, washing machines, etc., will not only continue to be installed in large numbers, but a very great increase can be anticipated in the first two mentioned in the immediate future. For this reason, it seems desirable to take such steps now as may be necessary to insure the use of motors which will entail minimum charges for operation by the user and minimum investment on the part of the electricity supply companies.

In view of these facts the motor manufacturers are urged to develop fractional horsepower motors which will meet the specifications listed below. It is also urged that the motor manufacturers further in every possible way the use of such improved motors on appliances which would otherwise cause undesirable disturbances on lighting circuits.

RECOMMENDED SPECIFICATIONS

1. These specifications apply to motors which are normally connected to lighting circuits and which may be expected to operate at times during the lighting hours.

2. The ¼-hp. motor shall have at least such full load efficiency and full load power factor that the product of these two values, known as the apparent efficiency, shall not be less than 42 per cent. The values for other sizes shall be adjusted accordingly.

3. It is desired that, as rapidly as possible, motors shall be produced which in the ¼-hp. size shall have a full load efficiency of at least 75 per cent and a full load power factor of at least 70 per cent, giving an apparent efficiency of at least 52.5 per cent.

4. No motor (either repulsion, split phase or other type) intended for use on 110-120-volt lighting circuits should have a starting current of more than 15 amp.

5. Motors shall be so connected to appliances that unnecessary noise is avoided, so that bearings are readily accessible for oiling and so that all parts which may require attention may be reached and inspected readily.

Discussion brought out the fact that the use of motors with unnecessarily low power factor and efficiency on equipment of the type under discussion increases the cost both to the user and to the central station company, in addition to affecting the quality of electric service which the customer receives. With the increasing number of people living in suburban towns adjacent to metropolitan cities, the service requirements of customers upon the power companies are becoming ever more exacting. Even in the more densely populated urban districts it was pointed out that in many families where both the man and wife are working, washing and ironing machines are being operated at night during the lighting hours. Operation of these devices causes objectionable voltage fluctuations which result in complaints to the service company from the customers. To alleviate this condition it has become necessary for the power companies in many instances materially to increase their investment in distribution equipment; that is, transformers, secondaries, service wires, etc. As the central-station companies' investment which is directly affected by power factor ranges, say, from $100 to $200, or more, per kva., it has been found that the installation of a ¼-hp. motor with low power factor characteristics requires an additional investment in system capacity of $20 or more. This in turn is ultimately reflected in higher rates for energy consumed.

Efficiency of the motor becomes an important consideration to the user of appliances operating over long-hour periods and moderate increases in efficiency would result in a very considerable saving over a period of a year. In the case of an electric refrigerator fitted with a motor having a maximum efficiency of 48 per cent but which under normal load operated at 35 per cent efficiency, a 20 per cent increase in motor efficiency would have resulted in a saving to the user of $10 to $15 per year. In this connection it was suggested that the motor and appliance manufacturers might design their respective apparatus so that the maximum efficiency of the motor would more nearly coincide with the principal operating point of the driven device.

EFFECT ON PRICE

Use of higher-power-factor and higher-efficiency motors might possibly somewhat increase the retail price of motor-driven appliances, but the user, it is believed, would very quickly save the difference through greater economy in energy consumption and in the long run more devices would be sold because of their improved efficiency and service qualities.

Appliance manufacturers pointed out that changing the type or design of motors now used would probably call for changes in the appliances entailing considerable expense for redesigning and altering manufacturing processes. It was also declared that

in the case of one type of appliance the use of a motor costing perhaps $5 more than the one now used would result in increasing the price to the ultimate purchaser by approximately $15 as the ratio of manufacturing cost to retail price is of the order one to three. Price, the manufacturers feel, is one of the most serious sales resistances and they are reluctant, in view of past efforts toward price reductions, to make a change which would result in boosting the selling prices of their products.

A number of central-station companies have, however, already found it necessary to place certain restrictions upon the capacity of motors which may be connected to their 110-120-volt lighting circuits. One company reported making a very considerable expenditure to increase the size of service wires and in some cases change the motors of customers using coffee mills, meat grinders, shoe repair machines, house pumps, oil burners, dish washers and other devices. Another company has issued a rule that any motor intended for use on lighting circuits shall not require more than 15 amp. to start, otherwise it should be made for 220-volt service. Many power companies are considering the promulgation of a similar rule and there is a strong tendency toward adopting such restrictions on the characteristics of motors which may be connected to lighting circuits.

It was the intention of this conference to ascertain just what steps would be necessary on the part of the appliance manufacturers and motor manufacturers to bring about the desired changes in the use of small motors. Certain obstacles must be overcome such as clearing of existing stocks now in the hands of dealers, jobbers and manufacturers and changes in design and possibly in dimensions of appliances and motors. Whether this would require three to six months or a year could not be determined at this conference, but it was decided to invite motor and appliance manufacturers to appoint representatives empowered to speak for their interests. These representatives are to meet at an early date and draw up a plan and schedule which will be acceptable to all.

The following associations and manufacturers are being asked to send representatives: National Electrical Manufacturers' Association, Association of Edison Illuminating Companies, National Electric Light Association, American Washing Machine Manufacturers' Association, Electric Refrigeration Council, Ironing Machine Manufacturers' Association, manufacturers of house pumps and other devices using fractional-horsepower motors intended to operate from lighting circuits. In order to avoid as much delay as possible in agreeing upon a plan of procedure it is expected that the meeting of these representatives will be held within the next few weeks.

Business Conditions

SALES in January were less than were expected in the electrical industry but from many sections of the country reports indicate that more active negotiations are under way than for the same period last year. An order placed by a central-station company for Babcock & Wilcox water-tube boilers and appurtenances amounted to over $1,000,000 and circuit breaker equipment and motor-operated valves purchased by the same utility company amounted to $100,000. Two transformer and switching equipment sales in the St. Louis district amounted to $117,000, and a contract covering $80,000 worth of motors was placed by a manufacturer of small pumps and compressors. A frequency changer purchased in the Carolinas amounted to $125,000, and three orders for transformers, switchboards and voltage regulators which were placed in the Southeast totaled $78,000.

In New England a lull in sales prevails but the activity in negotiations is increasing. Small motor sales increased, and several industrial and street lighting installations are planned. Inquiries are many in volume but sales are slow in the New York district. In the Southeast central-station orders sustain the volume of business. Synchronous motors for ice plant use are in active demand. Several motor orders ranging from $4,000 to $5,000 each were placed. Several good-sized orders were received by manufacturers in the St. Louis district both from central-station and industrial companies. Large orders were placed by utility companies in the Middle West, and in most sections a slight acceleration in trade has been noticed. On the Pacific Coast buying of power apparatus was active although orders for motors were small and scattered.

Copper and Tin Active—Lead and Zinc Dull—Prices Weaken

The copper market has been active, but price concessions were made by producers who offered the metal freely at 13 cents in the East. More than 15,000,000 lb. was sold, but on Wednesday domestic buyers seem to have lost interest again. According to figures just issued by the American Bureau of Metal Statistics, consumption of copper by principal domestic industries totaled 443,825 tons in 1926, against 418,900 tons in 1925. Zinc and lead have been dull, but consumers have bought tin in fair volume.

NEW YORK METAL MARKET PRICES

	Jan. 26, 1927 Cents per Pound	Feb. 2, 1927 Cents per Pound
Copper electrolytic	13¼	13
Lead, Am. S. & R. price	7.40	7.40
Antimony	14¾	14¾
Nickel, ingot	34	35
Zinc spots	6.80-6.85	6.925
Tin, Straits	65¼	67
Aluminum, 99 per cent.	26	26

Base copper price Feb. 2, 1927, 15 cents.

Lull in Sales Prevails in New England District

Continued lull in buying marks the condition in the New England district, with little activity in industrial and power equipment noted. This does not mean that the market is at a standstill since the activity in negotiations is increasing and is ahead of the corresponding month in 1926. Small-motor sales improved somewhat over the previous week, inquires for small switches are numerous, and a prominent manufacturer records that production is being maintained above normal to meet demands. A similar status is reported by a prominent manufacturer of small motors.

Central-station companies are gradually increasing their stocks, are negotiating for wire and hardware and are making encouraging demands for fiber conduit. Industrial electric lighting is active, and more factory installations are being contemplated at this period than at the same time last year, according to a prominent central-station official. Street lighting is also attracting much interest. Jobbers report spotty trade conditions throughout the district.

Large Orders Placed in Middle West

Business conditions in the Middle West assumed normal proportions, and in most sections there has been a slight acceleration in trade as compared with the previous week. Sales during the coming month are expected to be entirely satisfactory. In the utility field considerable activity is noticed. Among the interesting orders placed were one for six Babcock & Wilcox water-tube boilers, superheaters, economizers, and appurtenances valued at over $1,000,000; two turbine-driven boiler-feed pumps complete with appurtenances; three motor-driven centrifugal boiler-feed pumps with appurtenances; circuit breakers valued at $50,000, and a quantity of 60-in. motor-operated gate valves valued at $50,000. There has been a normal demand for wiring devices and conduit. Appliance sales are generally good, with prices remaining firm.

Central-Station Orders Sustain Volume in Southeast

The month of January as a whole has been somewhat more quiet than the same month last year in the Southeast. Inquiries rather than orders seem to predominate in the electric business, though all indications are for a brisk spring trade. Central-station orders continue to sustain the volume of sales generally, the largest single order last week being for a frequency changer for installation in the Carolinas, the amount involved being $125,000. Other interesting central-station orders placed in the past ten days were for $40,000 worth of 110,000-volt transformers and two orders for switchboards totaling $18,000. Another central-station order was for voltage regulators amounting to $20,000.

Municipalities in the aggregate are

quiet, though there is a tendency on their part to expand their ornamental street-lighting systems. A considerable number of small or moderate-sized orders for this equipment have served to build up a satisfactory volume of business. The largest single order recently received was for 100 units for installation in a Mississippi town, the amount involved being approximately $6,000. Ice-plant electrification is coming in for considerable attention, and orders for motors of the synchronous type of 50 hp. to 100 hp. are on the sharp increase, while small industrial plants are also placing orders for small motors in very satisfactory volume. One manufacturer reports the receipt of several orders ranging from $4,000 to $5,000 each.

Inquiries in Large Volume but Sales Slow in New York District

A large volume of inquiries for all kinds of central-station equipment continues to be received by manufacturers in the New York district. Sales are considerably slower in almost all lines, although a considerable demand is reported for substation equipment. Transformers are quite active as regards negotiations, and the inquiries point to a large amount of buying in this field in the near future. Switching equipment, circuit breakers and line hardware are quiet in point of view of sales, but manufacturers are optimistic regarding the future. Motors for general industrial purposes are in fair demand, and automatic control apparatus is moving briskly. Jobbers report a steady market for conduit, fittings, etc.

Several Power Apparatus Orders Placed on Pacific Coast

Machinery and power apparatus orders on the Pacific Coast have included four transformers of 500 kva. each having a total value of $13,000, printing-press motors and control costing $3,000, a bank of 132-kva., 11,000-volt induction regulators valued at $12,000, and twenty-one regulators, 48-kva., 2,200-volt, valued at about $30,000. An outstanding order covered four synchronous condensers, each of 5,000-kva. capacity, having a total value of $100,000, for the city of Los Angeles. This latter order was placed with the Allis-Chalmers Manufacturing Company. Power company orders also included ten carloads of 35-ft. and 40-ft. poles for Richmond and Stockton delivery, one carload of No. 6 bare copper wire, one-half carload $\frac{7}{16}$-in. strand, 2,000 pin-type, 35,000-volt porcelain insulators, besides considerable miscellaneous material such as tools and hardware for maintenance work.

The majority of motor sales made in Seattle were small and scattered and were mainly for replacements. It is reported that the Pacific Power & Light Company will spend $170,000 at Yakima this year in the reconstruction of its transmission line between Sunnyside and Prosser and also its distribution lines. Two milk plants costing $80,000 are planned for Whatcom County, and the Long Bell Lumber Company plans an increase in capacity of its Longview plant from 18,000 kw. to 24,000 kw.

Several Good-Sized Orders Placed in St. Louis District

Several good-sized orders have been reported as received from central-station and industrial companies in the St. Louis district. A turbo-generator unit having a capacity 6,000 kva. was sold to a central-station company in the Texas Panhandle district. This unit will be installed in one of the power stations in the central part of the northwest Texas oil field and will be used largely for oil-well pumping. Another order noted is for a system of remote control for a distribution system about 30 miles from the power station. An order was placed for 150 25-kva. transformers, amounting to about $37,000, for use in the rice fields of northwest Arkansas, for furnishing power for low-head pumping. One of the large local power companies purchased automatic switching equipment and transformers with regulating apparatus, to the total amount of $80,000. An industrial plant manufacturing automatic pumps and compressors for gasoline filling stations placed an order for motors from ¼ hp. to 5 hp., totaling over $80,000.

Activities of the Trade

Celeron Company Now Separate Division of Diamond State Fibre

Formation of the Celeron Company, which will be operated as a separate division of the Diamond State Fibre Company, Bridgeport, Pa., has been announced. The company says that the continued increased demand by the electrical and radio industries for Celeron insulation and by the automotive and other industries which use gears for Celeron non-metallic gear stock has made this change necessary.

The Celeron Company, which will be an entirely self-contained organization, is incorporated under the laws of Delaware with a capital of $2,000,000. The officers are: J. M. Taylor, president; T. E. Webster, vice-president in charge of sales; R. R. Titus, vice-president in charge of production; J. A. Ranck, secretary and treasurer, and D. B. Reeves, comptroller. The home office and principal factory of the company are at Bridgeport, Pa., and it has fabricating factories at New York, Chicago, Cincinnati, Boston and San Francisco. District offices have been located at Boston, New York, Philadelphia, Cleveland, Spartanburg, Detroit, Chicago, Milwaukee, Minneapolis, St. Louis, Kansas City and San Francisco.

General Electric Develops Plans for Refrigerator Merchandising

In accordance with the announcement of the General Electric Company to form a separate department to handle its electric refrigeration business, as announced in the Jan. 8, 1927, issue of the ELECTRICAL WORLD, the two refrigerator manufacturing plants which the company has been operating at Schenectady and Fort Wayne will be continued and expanded as the company develops its merchandising program. The G. E. electric refrigerator, which has been under development for the past fifteen years, is now being produced in two sizes for domestic use. The company's present plans call for a line of at least eight models of domestic refrigerators, ranging in price from $260 to $600.

This new department will market refrigerators through electric utilities, distributor-dealers and dealers. Distributor-dealers will sell direct to residential customers and also through sub-dealers in the territory allotted to the distributor. Most of the distributorships will be limited to one county or to a territory with a radius of not more than 25 miles. Distributors have been appointed in several large cities, and several more appointments will be made soon.

An extensive electric refrigeration advertising program, calling for an expenditure of $1,000,000 in 1927, has been planned, starting May 1. This includes a complete advertising service and sales assistance program for distributors and dealers, consisting of co-operative newspaper advertising, direct-mail campaigns, booklets, publications, window displays and a full complement of dealer helps that will help distributors in localizing the national campaign in leading national and trade journal publications.

Westinghouse Gets Order for Large Condenser Equipment

A contract for six 15,000-sq.ft. radial-flow, single-pass, vertical-type condensers and auxiliaries has been awarded to the Westinghouse Electric & Manufacturing Company by the Commonwealth Edison Company, Chicago. The equipment is for installation at the Crawford Avenue station of the company, and will serve the three-cylinder, 104,000-kw. steam turbine which the Westinghouse company is now manufacturing at its South Philadelphia works.

National-Harris Wire Company Formed by Consolidation

Consolidation by purchase of the Harris Alloys, Inc., the National Alloyed Metals Company and the Murray-Harris Wire Company has been announced, and the business of these companies is hereafter to be conducted under the name of the National-Harris Wire Company, 605 North Third Street, Newark, N. J. All obligations of the three companies will be assumed by the National-Harris Wire Company.

The rod mill of the company is at 51 Rome Street, the wire mill at 605 North Third Street, and the executive offices at 113 Orchard Street. The officers of the company are: Francis R. Harris, president; Francis A. Harris, first vice-

president; Frederick T. Harris, second vice-president; Albert E. Harris, secretary, and Joseph W. O'Loughlin, treasurer.

Electric Bake Ovens for First National Stores, Inc.

Two 600-kw. electric ovens for bread baking have been purchased within the past few days by the First National Stories, Inc., for installation at the new Somerville (Mass.) bakery of this organization. The contract for the ovens has been awarded to the Baker-Perkins Company, Saginaw, Mich., and electric service will be supplied by the Edison Electric Illuminating Company of Boston. The ovens will be designed for 440-volt, three-phase service, and each will have a capacity of 5,500 lb. per hour.

Worthington Pump Buys Harris Air Pump Company

Announcement has been made by the Worthington Pump & Machinery Corporation, 115 Broadway, New York, of the purchase by it of the Harris Air Pump Company of Indianapolis, for some years one of the foremost manufacturers of air-lift systems and air-lift pumps. The former company states that this purchase was outright and includes patents, drawings, patterns and good will. This new acquisition will permit the Worthington Pump company to offer complete well equipment, including compressors, produced in its own plant.

American Brass Takes Over Du Pont Everdur

The American Brass Company announces that arrangements have been completed whereby it will take over the manufacture and sale of "Everdur" metal from the Du Pont Everdur Company. "Everdur" is a trademarked and patented alloy of copper, silicon and manganese. It was developed by the Du Pont company in its search for a metal that would combine the tensile strength and elastic limit of low-carbon and medium-carbon steels with good machining and working qualities and high resistance to a large number of corroding agents. It casts readily and can be dropforged, stamped and pressed.

The Servel Corporation, 51 East Forty-second Street, New York, at a meeting of its stockholders had its plan for increasing its stock unanimously approved. This plan was reported in the Jan. 29 issue of the ELECTRICAL WORLD.

The General Electric Company, has recently paid $1,358,669 as supplementary compensation to 30,518 employees who have had five years or more of service with the company.

The Lamson Company, Syracuse, N. Y., announces that Samuel W. Phelps has been appointed wholesale manager of the refrigerator division. Mr. Phelps was formerly vice-president of the Smith Ironer Company. The Lamson Company also announces that Harry A. Bell has been appointed Southern field representative, George A. Boivin has been made Chicago district manager, and J. M. Mero has been made assistant general manager, with headquarters at Syracuse.

The Standard Thermometer Company, Boston, announces that it has taken over the sale of Standard semaphores for use on all types of transformers. Their sale was formerly handled by the Condit Electrical Manufacturing Company as exclusive distributor of this product.

The Frigidaire Corporation, Dayton, has awarded a contract for the erection of a one-story addition to its plant at Moraine City.

The Electric Refrigeration Company, Detroit, announces that B. A. McDonald, formerly president of the Commercial Trust Company of Chicago, has since Jan. 1 been president of the Refrigeration Discount Corporation and vice-president and treasurer of the Electric Refrigeration Corporation. The Discount corporation, which is owned by the Refrigeration corporation, was organized to handle the deferred payment paper acquired by the Refrigeration corporation.

The Midwest General Electric Supply Company, a new subsidiary of the General Electric Company, has purchased the business of the Midwest Electric Company of Omaha, Neb. The latter company, known until four years ago as the Johnson Electric Company, has been a distributor of electrical goods in Nebraska, Iowa and several adjoining states. The new corporation will also maintain a distributing plant in Des Moines.

The Conlon Corporation, Nineteenth Street and Fifty-second Avenue, Chicago, manufacturer of domestic electric washing and ironing machines, announces the appointment of J. L. Mayer as ironer sales manager. Mr. Mayer was formerly manager of the ironer machine division of the Electric Household Utilities Corporation, Chicago.

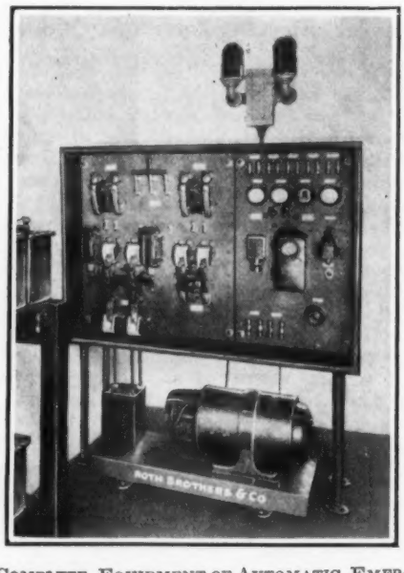
The U. S. Electrical Manufacturing Company, Los Angeles, motor manufacturer, announces that it has let the contracts for the erection of a steel fireproof factory building on its 5¼-acre property. The building for which the contract has just been let will be used mostly as a non-ferrous metal foundry.

Fitts-Morse, Inc., 161 Summer Street, Boston, manufacturers' representative, has since Feb. 1 dissolved in order to put into operation a plan of sales segregation under which Daniel Fitts and Harold Morse will handle separate lines as follows: Mr. Fitts will devote his entire time to service as New England representative of the electrical products of the Colts Patent Fire Arms Company, Hartford, formerly manufactured as the Johns-Pratt line, and Mr. Morse will represent the Frink Company, Inc., and other houses whose accounts were formerly handled by Fitts-Morse, Inc. Offices will be continued by each of the two men at the above Boston address.

New Equipment Available

Emergency Lighting System

The Roth emergency lighting system, which is entirely automatic, has been developed by Roth Brothers & Company, 1400 West Adams Street, Chicago. The system provides emergency power supply under any possible operating conditions and has three sources of supply. The first source of power is the regular power supply, the second source is the special heavy-duty glass-jar storage battery provided as a part of the system, and the third source is the motor-generator itself. The capacity of the machine is varied to suit the individual conditions, and, depending upon the individual requirements, the battery can carry the necessary load for as long as eight hours.

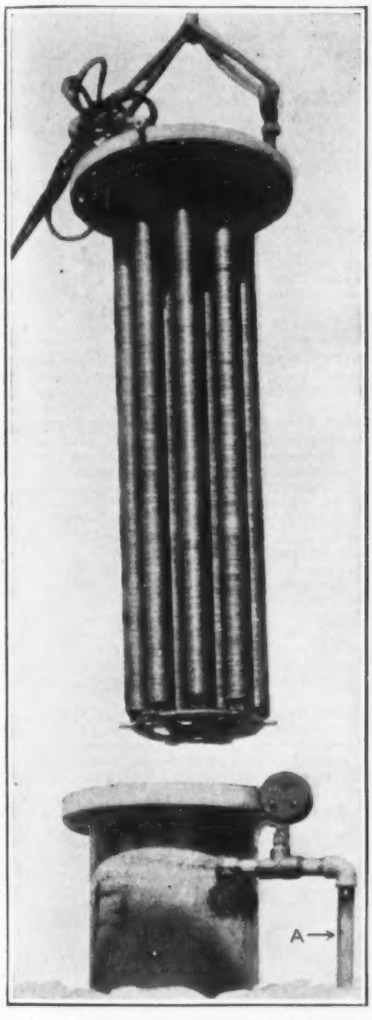


COMPLETE EQUIPMENT OF AUTOMATIC EMERGENCY LIGHTING SYSTEM; ONLY PART OF BATTERY SHOWN

The battery is kept continuously charged by the motor-generator set operated at regular intervals by an automatic time switch. The time clock also automatically operates all of the equipment on the system panel at regular intervals, so that any failure in operation would be thus disclosed. The equipment is contained in one compact installation, as shown in the illustration, and in the entire system there is no apparatus that requires regular maintenance or attention.

Oil Filter

The "Diskelectro" oil filter, using the principle of edge filtration between thin disks of metal, has been developed by S. F. Bowser & Company, Inc., Fort Wayne, Ind. The distance separating the disks is infinitesimal, and uniformity of spacing is achieved by electrodepositing metal projections on the disks. The assembled disks make up the inner element of the filter, as shown in the illustration. The low surface tension of oil permits of its passage



OIL FILTER WITH INNER ELEMENT REMOVED

between disks, but the higher surface tension of the water globules prevents their passage through the same space. Moderate pressure forces the oil through, and complete filtration of solid impurities is accomplished. The outstanding advantages claimed by the manufacturer are: Performance results are independent of the weather because the purification process takes place in an air-tight filter; the filter contains no moving parts; no tanks are required since the filter takes the oil directly from and returns it directly to the transformer; only one pump and motor are required; one passage of oil completely restores dielectric strength; no heaters are required; constant attention is unnecessary, and cleaning is accomplished by back-washing with oil for a few minutes.

Hig-Speed Unit for Electric Range

A flat-surfaced, closed, high-speed heating unit for household ranges, or for other applications where an electrical hot plate is required, as in laboratories, industrial plants, etc., is being manufactured by the Edwin L. Wiegand Company, 422 First Avenue, Pittsburgh. The unit consists of two of the company's standard "Chromalox" ring units of high-temperature metal sheath with rivets to hold them in place in a cast-iron supporting plate. The manufacturer states that connection is easily made to the three terminals, which are completely inclosed in a pressed-steel adapter, and by using a three-heat switch three degrees of heat is secured.

Drain Valve for Tubular Tanks of Transformers

A new type of drain valve for tubular tanks of transformers has been adopted by the General Electric Company and may be screwed into place without disturbing any tubes. The valve was developed from the standard Y-tube blow-off valve which is used in steam work to obtain a straight-through passage. The stem and hand wheel are set at an angle to the body, thus bringing the wheel into a more convenient position for the operator. A bakelite disk insures oil-tightness, and there is a special sampling device with a connection for "Alemite" hose. With previous drain valves it was necessary to cut off the tubes on tanks in the vicinity of the valve so that it could be screwed into place without dismantling.

Deep-Groove Ball Bearings

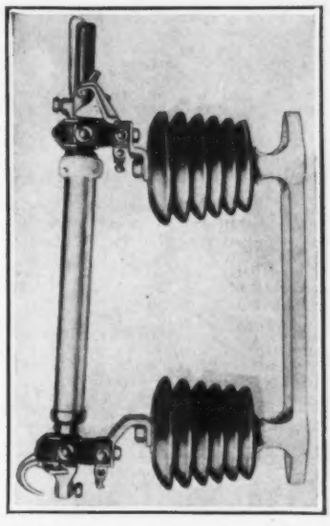
A new type of deep-groove ball bearing in standard sizes, in both the double-row and the single-row type, is being marketed under the name of "Schubert" by the McGill Metal Company, Valparaiso, Ind. The manufacturers claim that the dimensional tolerances of these bearings have been reduced to approximately one-half of the standard S.A.E. tolerances and that particular attention has been given to the finish of the high-carbon, alloy-steel surfaces of the races and the balls. The bearings are of the deep-groove, non-filling slot type and, it is said, are capable of carrying axial or thrust loads in either direction. The retainer for the bearings is made of McGill metal, which is a modified aluminum bronze that may be die-cast within very small tolerances and has physical properties closely approximating those of mild steel.

Metallic Flexible Coupling

A metallic flexible coupling of new design has been placed on the market by W. H. Nicholson & Company, Wilkes-Barre, Pa. The coupling consists of two flanges or hubs, with slotted rims, which are keyed to the shaft, a two-piece shell and three or five tapered keys to fit it to the slot. Shaft misalignments are taken care of by means of loose-fitting, floating keys with beveled sides. In the small sizes of couplings three keys are used and on the larger sizes five. When in motion centrifugal force throws the floating keys out into the slots, but when the torsional load comes on the centrifugal force acting on the floating keys is overcome and they recede to the bottom of the slots. The interior of the coupling is filled with oil. A film of oil is maintained between the keys and slots at all times to allow a free lateral float of the coupling hubs. The coupling is available for all sizes of shafts and conditions of service.

Outdoor Expulsion-Type Fuse Switch

An outdoor expulsion-type fuse switch for 7,500 volts and 15,000 volts with 13,000, 20,000 and 25,000-volt insulators has been placed on the market, along with a complete line of disconnecting switches, choke coils and combinations, by the James R. Kearney Corporation, 4224 Clayton Avenue, St. Louis. This fuse switch has been designed for loads up to 100 amp. for the highest altitudes, for dust, fog, and acid-fume conditions, for clearing the severest shorts, and for preventing leakage over the dead cartridge. Distinctive features incorporated in this fuse switch are said by the manufacturer to include self-aligning, full-floating contacts; combination clamp and screw-type lugs, flat surface base for



FUSE SWITCH WITH REMOVABLE CARTRIDGE INTERCHANGEABLE WITH DISCONNECTING BLADE

cross-arm U-strap mounting, removable cartridge interchangeable with a disconnecting blade, positive lock, blade stop, cartridge re-fusable in the field, insulator inserts which are alike, and convertibility for mounting in any position.

Main Fuse Switch.—An accessible main fuse switch with a distribution cabinet has been added to the line of the Square D Company, Detroit. This new-type switch has main fuses which are accessible when the switch is in the "off" position. The switch has one fuse, one switch blade and a solid neutral. The distribution cabinet provides for two branch circuits.

Safety Switch.—A new line of 600-volt, double-throw safety switches, with quick-make and quick-break action and fitted with the company's arc-snuffing features, has been placed on the market by the Trumbull Electric Manufacturing Company, Plainville, Conn. These switches are available either fused or unfused, in the two, three and four-pole type and in capacities from 60 amp. to 200 amp.

New Trade Literature

TURBINES.—Bulletin GEA-578 issued by the General Electric Company, Schenectady, N. Y., describes and illustrates the General Electric type D mechanical-drive turbines for operating centrifugal pumps, boiler-feed pumps, etc.

SWITCHING EQUIPMENT. — Bulletin No. 312 issued by the James R. Kearney Corporation, 4224 Clayton Avenue, St. Louis, describes and illustrates a complete line of switching equipment for 7,500 volts and 15,000 volts with 13,000, 20,000 and 25,000-volt insulators, including fuse switches, disconnecting switches, choke-coil combinations and choke coils.

CONDUIT FITTINGS. — The Killark Electric Manufacturing Company, 3940 Easton Avenue, St. Louis, is distributing a catalog sheet showing nine new types of conduit fittings, known as "electrolets," designed for use on exposed rigid conduits such as are employed in factories, garages, etc.

BALL BEARINGS.—Bulletin P-1 issued by the Marlin-Rockwell Corporation, Gurney Ball Bearings Division, Jamestown, N. Y., calls attention to the use of ball bearings in deep-well pumps. It contains illustrations showing various types of deep-well pumps equipped with Gurney ball bearings. Dimensions, tables and radial load ratings are included.

DATA FOR SELLING FANS. — The Robbins & Myers Company, Springfield, Ohio, is distributing its dealers' sales manual (No. 1,306) entitled "Sale Points and Appeals of Robbins & Myers Fans," prepared for the use of the jobber and dealer salesmen. It calls attention to the benefits and the physical qualifications of the "R. & M." fans and to the various methods of demonstrating the fans.

STEAM TURBO-GENERATORS. — Descriptive circular No. 100 issued by the American Brown Boveri Electric Corporation, 165 Broadway, New York City, describes the distinguishing features of the American Brown Boveri turbines. The booklet, which is well illustrated, points out the advantages in the construction and operation of the company's turbines, and the generator equipment is fully described. A number of photographs of typical steam turbo-generator installations are also included. Several views are given of the construction model of the 160,000-kw. steam turbo-generator set designed for the United Electric Light & Power Company's Hell Gate station at New York.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Richmond, Australia (No. 23,814), of automatic controls for refrigerating machinery.

Purchase and agency are desired in Alexandria, Egypt (No. 23,812), for flexible cables and wires, push-button switches, electric bulbs, electric cooking and laundry equipment. An agency is also desired (No. 23,808) for electric machinery in general, small electric refrigerators and for high-horse-power Diesel engines.

Purchase and agency are desired in Ciegode, Avila, Cuba (No. 23,865), for electric coffee mills.

An agency is desired in Toronto, Canada (No. 23,813), for electric cooking and heating appliances. Purchase is desired (No. 23,817), of radio sets and parts.

Purchase is desired in Vienna, Austria (No. 23,816), of electrical cooking and heating appliances, electrical household appliances and electric refrigerators.

Purchase and agency are desired in Berlin, Germany (No. 23,810), for electrical appliances and equipment.

Purchase is desired in Bombay, India (No. 23,818), of electric gold and silver refining furnaces and equipment.

An agency is desired in Copenhagen, Denmark (No. 23,796), for electrical household appliances. Purchase is also desired (No. 23,867) of store-lighting equipment and of electric refrigerating units (No. 23,816).

Purchase and agency are desired in Hull, England (No. 23,773), for radio sets and parts.

An agency is desired in Calcutta, India (No. 23,819), for radio sets and parts.

An agency is desired in Frankfort, Germany (No. 23,820), for domestic electric refrigerating units. Sole agency is also desired (No. 23,834) for automobile accessories and novelties, such as automatic windshield wipers, electric horns and spot lights.

Purchase is desired in Johannesburg, South Africa (No. 23,801), for electrically driven high-speed textile machines for sewing cottonades and khaki trousers, and automatic pressing machines.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 8, for incandescent lamp sockets, attachment plugs, etc. for the Boston Navy Yard; also, similar supplies for the Brooklyn, Mare Island and Puget Sound yards (Schedule 6657).

HOLYOKE, MASS.—A license has been granted the Holyoke Water Power Company by the Department of Public Utilities covering the construction of a hydro-electric plant at the Holyoke end of the dam across the Connecticut River. This license also includes the excavation of a discharge channel so as to produce a normal head of 45 ft. under ordinary conditions. Authority has been granted the company by both the State and Federal authorities to erect another high-tension line across the river, and it is expected that steel towers will be erected in the spring at both ends of the existing dam, which will provide means of transmitting energy to the town of South Hadley for distribution by the municipal electric plant. Robert E. Barrett is president.

CLINTON, CONN.—The Clinton Electric Light & Power Company has petitioned for permission to generate and distribute electricity in the town of Killingworth.

NORWICH, CONN. — The Connecticut Company, New Haven, has awarded a contract to P. F. Sweeney, Norwich, for the construction of its proposed local substation, to cost about $20,000. R. W. Foote, New Haven, is architect.

Middle Atlantic States

BELLPORT, N. Y.—The Patchogue Electric Light Company has applied to the Public Service Company for permission to construct an electric light plant in Bellport and for approval of a franchise granted by the Town Board.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 8, for delivering to the Navy Supply Depot, Brooklyn, attachment plugs, lamp sockets, vacuum outfit, etc.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 15, for 800 electric flash-lights for the local navy yard (Schedule 6699); also, at the same time for 15,000 ft. incandescent lamp cord (Schedule 6700); for one telephone system (Schedule 6701); and for electric brackets, etc. (Schedule 6707).

HELMUTH, N. Y.—Bids will be received by the Department of Mental Hygiene, Capitol, Albany, until Feb. 16, for fire-alarm system for the Gowanda State Homeopathic Hospital, Helmuth.

LOUISVILLE, N. Y.—Permission has been granted the St. Lawrence County Utilities Inc., Potsdam, to extend its plant in the town of Louisville and the exercise privileges granted under a franchise by the Town Board.

WILDWOOD, N. J.—Plans are being considered by the City Commissioners for the installation of an ornamental lighting system on Pacific, Oak and Wildwood Avenues, using iron standards, to be maintained by underground conduit lines. The entire cost is estimated at $21,000.

JENKINTOWN, PA.—The Reading Railway, Reading Terminal, Philadelphia, plans to build an automatic substation at Jenkintown, Bethlehem and Orvilla, for power supply for a proposed automatic train control system in this section.

NANTICOKE, PA.—Plans are underway by the Luzerne County Gas & Electric Company, Kingston, for the construction of a steam-operated electric plant on the Susquehanna River, to be designed for an ultimate capacity of 200,000 kw. A transmission line will be built.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for 35,000 ft. of ignition cable for the local navy yard (Schedule 6664).

WEST CONSHOHOCHEN, PA. — The Valley Forge Cement Company, recently organized by J. W. Fuller, Catasauqua, and associates, plans to build an electric substation at its proposed local mill. Cost of the entire plant is estimated at $2,000,000.

MARTINSBURG, W. VA.—Plans for the proposed local cement mill to be erected by the Standard Lime & Stone Company, Equitable Building, Baltimore, at a cost of about $750,000, include a power plant.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until Feb. 9, for a quantity of magnet wire, anchor lights, etc. (Panama Circular 2433).

WASHINGTON, D. C.—Bids will be received at the office of the General Purchasing Agent, the Panama Canal, Washington, D. C., until Feb. 19, for ridge roll, cable clips, pumps, speed reduction units, electrodes, etc., as per Circular 1784.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, Washington, until Feb. 17 (postponed from Feb. 7), for telephones, connecting blocks, etc. (Proposal C. P. 23867-1).

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until Feb. 15, for two megger testing outfits for the Indian Head and Bellevue navy yards. (Schedule 6711).

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until Feb. 8, for 30,000 ft. of light and power wire for the Great Lakes navy yard (Schedule 6710).

North Central States

DETROIT, MICH.—Bids will be asked in about thirty days by the Department of Public Works, City Hall, for an electric-operated emergency pumping plant on East Jefferson Avenue, etc., to cost about $1,000,000. Perry A. Fellows, City Hall, is city engineer.

MIDLAND, MICH.—Plans for the proposed condensing plant to be erected by the Detroit Creamery Company, Cass and Adams Street, to cost about $200,000 include a power plant. Albert Kahn, Inc., Marquette Building, is architect and engineer.

CINCINNATI, OHIO.—Plans are being prepared by H. B. Briggs, Ohio-Hartmen Building, Columbus, for a power house, to cost about $50,000, for the Longview State Hospital for the Insane, Cincinnati. J. E. Harper, Ninth and Oak Streets, Columbus, is director of Department of Welfare.

MIDDLETOWN, OHIO.—Plans for the proposed paper mill to be erected by the Paul A. Sorg Paper Company, at a cost of about $650,000, include a power plant. Warren D. Spengler, Union Trust Building, Cleveland, is engineer.

CHICAGO, ILL.—Plans are under way by the merchants and property owners in Washington Street, from Michigan Boulevard to Wells Street, for the installation of an ornamental lighting system, the lamps to be the same as those on State Street. The cost is estimated at $50,000.

KEWANEE, ILL. — The high-tension transmission line from the Keokuk (Iowa) hydro-electric plant into Kewanee is nearing completion. Surveys are now under way for the Joliet line, which is next to be finished, and the Rock Island and Peoria connections will follow.

NILES CENTER, ILL.—Bids will be received by the Board of Local Improvements, until Feb. 15, for the installation of an ornamental lighting system on Lincoln Avenue. Consoer, Older & Quinlan, 140 South Dearborn Street, Chicago, are engineers.

HARTFORD, WIS.—Bids will be received by the Utility Department, until Feb. 15, for equipment for a municipal power plant, including a bleeder type turbo-generator;

uniflow engine generating set, etc. Charles A. Cahill & Sons, 217 West Water Street, Milwaukee, are engineers.

OWATONNA, MINN.—The installation of an ornamental lighting system on Oak Street is under consideration by the City Council.

ST. PAUL, MINN. — Steps have been taken by the West End Improvement Association for the extension of the ornamental lighting system on Otto Avenue to the new Ford bridge.

CARROLL, IOWA.—The Iowa Light, Heat & Power Company has applied for authority to extend its transmission lines in O'Brien, Lyon and Sioux Counties.

WEST UNION, IOWA.—The Northeastern Iowa Power Company, Clermont, has applied for permission to extend its transmission lines in Buchanan and Fayette Counties.

ASH GROVE, MO.—The Empire District Electric Company of Kansas, Joplin, is negotiating for the purchase of the municipal electric plant.

FREDERICKTOWN, MO. — Arrangements have been made between the city officials and the Union Electric Light & Power Company, St. Louis, whereby the latter will supply electricity in Fredericktown. A transmission line will be extended from Mine La Motte by the Union company to furnish the service.

MEXICO, MO.—Plans are under way by the Missouri Power & Light Company to furnish electricity to the towns of Belle, Owensville, Bland, Rosebud, Linn, Chamois, Morrison, Berger and Hermann. At Osage City the transmission line will span the river. These towns have been supplied by the Gasconade Power Company, Hermann, but the demand has exceeded the capacity of its plants.

GRAFTON, N. D.—The Otter Tail Power Company, Fergus Falls, Minn., is planning to build a substation in Grafton, to cost about $20,000.

RUGBY, N. D.—The Otter Tail Power Company, Fergus Falls, Minn., which has acquired the municipal electric plant, plans to erect a transmission line from Devil's Lake to this section. The line will be extended to furnish service at Willow City, Barton, Leeds and vicinity.

NORTH LOUP, NEB.—The citizens have voted to sell the municipal electric plant to the Nebraska Power Company, Omaha. The local plant will be used until transmission lines can be erected from the company's high-tension system to supply service here.

PALISADE, NEB.—The Palisade Irrigation District, now being formed by S. C. Crotter, Palisade, and associates, contemplates the construction of a hydro-electric power plant on the Frenchman River, in connection with an irrigation development, to cost about $100,000.

CONWAY SPRINGS, KAN. — Arrangements are being made by the Western Light & Power Company, Salina, for the construction of a new power plant at Conway Springs. Diesel engine equipment for the plant has been ordered. The proposed plant will supply electricity in Conway Springs, Norwich, Milton, Viola, Milan, Argonia and Danville.

DANVILLE, KAN.—A franchise has been granted to the Western Sumner Light & Power Company, Argonia, to furnish electricity in Danville. Bonds have been authorized for the installation of a distribution system.

FREEPORT, KAN.—Bonds have been authorized by the voters for the installation of an electric distribution system and a street-lighting system.

HUTCHINSON, KAN. — Arrangements have been made by the United Power & Light Company, Abilene, to serve electricity to Abbyville, Arlington, Langdon, Plevna, Windom and Whiteside from the Hutchinson plant.

TOPEKA, KAN.—Work has started on the second unit of the Tecumseh plant of the Kansas Power & Light Company, which will include the installation of a 22,500-hp. turbine.

VASSAR, KAN. — Arrangements have been made to secure electricity from the Lyndon-Melvern transmission line of the Municipal Power Transmission Company, Ottawa, to operate the local system.

WICHITA, KAN.—The erection of a transmission line from the Peabody substation to Newton, a distance of 21 miles, is included in the 1927 expansion program of the Kansas Gas & Electric Company. The company is also considering a contract with the Bartlesville (Okla.) Gas & Electric Company, which if accepted will require the erection of a transmission line from Coffeyville, about 30 miles long.

Southern States

JACKSON, ALA.—The Alabama Power Company, Birmingham, is considering the construction of an electric power plant here. The company is negotiating for the purchase of the municipal power station.

CADWELL, GA.—The Georgia Southern Power Company, Dublin, will construct a 2,300-volt distribution system, a street-lighting system and a 150-kva., 44,000/2,300-volt transformer in Cadwell.

RENTZ, GA.—The Georgia Southern Power Company, Dublin, plans to build a 2,300-volt distribution system, a street-lighting system and a 150-kva. 44,000/2,300-volt transformer station in Rentz.

MIAMI, FLA.—A petition has been presented to the City Commission for street lamps in Flagami and other subdivisions in the Western Miami district.

GORDO, ALA.—The municipal electric plant has been acquired by the Alabama Power Company, Birmingham. The new owners plan extensions and improvements to the system.

BLYTHEVILLE, ARK.—Plans have been completed by the Arkansas-Missouri Power Company for the erection of a 30,000-volt transmission line from Rector east through Greenway, Piggott, St. Francis, Ark., and Campbell, Clarkton, Gibson and Holcomb, Mo. The small plant at Campbell will be discontinued when the new line is completed.

BARTLESVILLE, OKLA.—The Bartlesville Gas & Light Company plans to install an ornamental lighting system on Second, Third and Fourth Streets, from Keeler to Osage Avenue.

WELEETKA, OKLA.—Work has started on the construction of the first 15,000-kw. generating unit at Weleetka by the Public Service Company of Oklahoma, Tulsa. The plans provide for an ultimate installation of 45,000 kw. in three units and plant will be connected by a 66,000-volt transmission line with the West Tulsa plant of the Oklahoma Power Company.

SPUR, TEX.—The West Texas Utilities Company, Abilene, which has acquired the local electric and ice plants, plans to extend its service to Jayton, Girard, Peacock, Aspermont, Bradshaw and Swenson. For the present these towns will be served from the Spur generating station which is to be enlarged for this purpose. Construction work will begin at once on the erection of a 66,000-volt transmission line from Spur through Girard to Jayton, and a 22,000-volt line is to be extended to Peacock, Aspermont and Swenson to serve these towns. In addition to the Spur properties the electric plants serving Jayton and Aspermont have been acquired.

Pacific and Mountain States

ABERDEEN, WASH.—Bids will be asked at once by the City Council for the installation of a proposed ornamental lighting system on Canyon Court. Grant D. Ross is city engineer.

HOQUIAM, WASH.—The Grays Harbor Pulp Company, operated by the Zellerbach Paper Company, Sacramento, Cal., plans to build a substation at its proposed pulp and paper mill. The cost of the entire project is estimated at $2,000,000.

TATOOSH, WASH. — Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 23, for wood radio masts for the local naval radio compass station (Specification 5284).

WINTHROP, WASH. — The Upper Methow Valley Light & Power Company, Winthrop, has applied for permission to use water from the Methow River, for a small hydro-electric plant.

TILLAMOOK, ORE. — The Mountain States Power Company, Tacoma, Wash., will install a 2,500-kw. turbo-generator in its local plant during 1927. The Byllesby Engineering and Management Corporation, 231 South La Salle Street, Chicago, will have charge of the work.

EUREKA, CAL.—The Western States Gas & Electric Company will install a 5,000-kw. turbo-generator in its local plant. The work will be in charge of the Byllesby Engineering & Management Corporation, 231 South La Salle Street, Chicago.

FRESNO, CAL.—The City Council is considering the installation of ornamental lamps on California Avenue, A. M. Jensen is city engineer.

HUNTINGTON BEACH, CAL.—The City Council is considering the installation of ornamental lamps on Huntington Avenue, using single lamp standards, maintained by underground wires.

LOS ANGELES, CAL.—Plans have been filed by the Bureau of Power and Light for the construction of a substation, at 9615 South Central Avenue, to cost about $150,000.

LOS ANGELES, CAL.—The City Council has approved an ordinance for the installation of ornamental lamps on Eagle Dale Avenue, and Mount Royal Drive, using concrete standards.

LOS ANGELES, CAL.—The City Council has adopted a resolution providing for the installation of ornamental lamps on Highland Avenue, from Pico to Venice Boulevard, and on portions of Marne, Verdun, Meadowbrook, Mansfield, Cloverdale, Citrus, Milton, Sycamore Avenues, and Orange Drive, using concrete standards.

MARE ISLAND, CAL.—Plans are being considered by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of three electric passenger elevators the local Navy Yard Hospital.

MARYSVILLE, CAL.—The City Council is planning the installation of ornamental lamps on a portion of Fifth Street.

MODESTO, CAL.—The City Council has rescinded a contract let for the installation of an improved lighting system in the west side district, totaling about 45 blocks. It is proposed to revise specifications and ask new bids at an early date.

POMONA, CAL.—Plans have been approved by the City Trustees for the installation of ornamental lamps on Holt Avenue. F. C. Froehde is city engineer.

SACRAMENTO, CAL.—The Pacific Gas & Electric Company, San Francisco, plans improvements in its electric power plant on Sixth Street, to cost about $45,000.

SAN DIEGO, CAL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 16 for the following work at the Naval Operating Base (Hospital) San Diego: Part 1—General construction of six buildings; Part 2—Plumbing and sewerage, drainage, water and gas system; Part 3—Steam heating and distributing systems, etc. Part 4—Electric lighting and power systems and telephone conduits.

SAN FRANCISCO, CAL.—The North Central Improvement Association has appealed to the Board of Supervisors for the installation of a modern lighting system on Sansome Street in the down town banking and commercial district.

SAN FRANCISCO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 8, for cable terminals, vibrating bells, etc., for the Mare Island Navy Yard (Schedule 6646).

SAN GABRIEL, CAL.—Plans have been filed by the Pacific Electric Railway Company, Los Angeles, for a substation here, to cost about $18,000.

DELTA, COLO.—The City Council is considering the installation of an ornamental lighting system on Main Street. Homer D. Graham is engineer.

ALBUQUERQUE, N. M.—The City Commission has authorized the installation of ornamental lamps on East Central Avenue. The installation of additional street lamps in the Heights district was recommended. The Albuquerque Gas & Electric Company furnishes the street-lighting service here.

Canada

VANCOUVER, B. C.—The installation of ornamental lamp standards, to cost about $50,000, has been approved by the civic, fire and police committee.

BATHURST, N. B.—Plans are under consideration by the Bathurst Company, Inc., for an additional hydro-electric development, to cost about $5,000,000.

TORONTO, ONT.—Plans are being prepared by Chapman & Oxley, Northern Ontario Building, for the machinery hall and electrical building at Exhibition Park, to cost about $700,000, for the Canadian National Exhibition, Lumsden Building.

MONTREAL, QUE.—The Montreal Island & Power Company is having plans drawn by the Power Corporation of Canada, Ltd., 20 St. Nicholas Street, Montreal, for a hydroelectric power plant on the Back River, near River des Prairies to cost about $5,000,000. The plans include a steel tower transmission line.

Electrical Patents

Announced by U. S. Patent Office

(Issued Jan. 11, 1926)

1,613,616. CONTACT-SPRING VIBRATION DAMPER; G. R. Lum, New York, N. Y. App. filed Dec. 13, 1920. For preventing the vibration of electrical contact springs upon being brought into and out of contact with contact means of varying height.

1,613,617. STORAGE BATTERY; A. Miller, Kirkwood, Mo. App. filed July 25, 1924. In which separators between plates are unnecessary; in which the plates have more than three times the amount of surface exposed to the action of the electrolyte than the present commercial batteries.

1,613,625. DYNAMO-ELECTRIC MACHINE; H. M. Stoller, Mountain Lakes, N. J. App. filed Dec. 30, 1922. Of the synchronous type; a commercial form of converter operable from a standard-voltage single-phase source to deliver a direct current of small value suitable for operating vacuum-tube apparatus, electric phonograph reproducers and the like.

1,613,647. ELECTRIC CORD CONNECTER; G. Davies and A. C. Mires, Montreal, Quebec, Canada. App. filed Sept. 14, 1925.

1,613,708. SWITCHBOARD CONSTRUCTION; L. S. Keilholtz and E. Dickey, Dayton, Ohio. App. filed July 19, 1920. For farm-lighting systems.

1,613,714. ELECTRIC WATER HEATER; A. Martin, Ogdensburg, N. Y. App. filed Sept. 27, 1923. In which the electrodes are supported within a suitable container for direct contact with the water therein for the purpose of maintaining a limited supply of hot water to be used when desired. Having thermo-electric means actuated by varying temperatures of the liquid in the container for controlling the temperature of the liquid involving the use of a flat thermostatic bar normally in direct contact with the periphery of the liquid-containing shell for the purpose of increasing its sensitivity to the varying temperatures of the liquid.

1,613,740. CABLE JOINT; N. E. Buck, D. W. Roper and A. P. Thomas, Chicago, Ill. App. filed June 7, 1924. Especially suitable for use in connection with cables in which the electric stresses are relatively low.

1,613,770. ELECTRIC HEATING DEVICE; L. Reichold, Winsted, Conn. App. filed Aug. 13, 1925. Hot-plate type for domestic use.

1,613,772. HIGH-FREQUENCY TRANSFORMER; K. Schmidt, Berlin-Sudende, Germany. App. filed Jan. 17, 1925.

1,613,802. SIGNALING SYSTEM; T. A. Mollard, Oakland, Cal. App. filed May 19, 1923. In which a plurality of signals may be independently transmitted and may be caused to affect independent receiving circuits for use with certain types of fire prevention circuits.

1,613,803. AUTOMATICALLY CONTROLLED SWITCH DEVICE; R. J. Patterson, Watertown, Mass. App. filed July 9, 1923. For use in controlling through electrical means devices such as electric heaters or ranges.

1,613,825. AUTOMATIC CONNECTOR; G. A. Harmon, Columbus, Ohio. App. filed Feb. 9, 1925. For lighting fixtures. A device which is adapted to be elevated or lowered by a cable and which is so constructed that it will automatically open or close the plurality of circuits to the various lamps of a lighting fixture.

1,613,878. PLATING EQUIPMENT; W. O. Emard, Brookfield, Ill. App. filed March 23, 1925. Whereby a given equipment may be employed to apply different kinds of platings to objects that are conveyed to the plating baths by a single conveyor.

1,613,902. ELECTRIC SWITCH; L. H. Phillios, Atlantic Highlands, N. J. App. filed May 9, 1925. Whereby a plurality of circuits may be controlled or operated through a central circuit selector.

1,613,910. TERMINAL BUILDING FOR OIL-FILLED CABLES; D. M. Simons, Osborne, Pa. App. filed Oct. 1, 1925.

1,613,911. METHOD OF BUILDING JOINTS; D. M. Simons, Osborne, Pa. App. filed Oct. 3, 1925.

1,613,955. STORAGE BATTERY; H. Lesley, Philadelphia, Pa. App. filed Sept. 20, 1923. Combined stopper and vent.

1,613,957. METHOD AND MACHINE FOR ELECTRIC WELDING; H. D. Madden, Newark, N. J. App. filed Jan. 19, 1923. For welding a lead-in wire of an incandescent electric lamp to the base.

1,613,959. PLUG SOCKET; L. Propp, New York, N. Y. App. filed July 23, 1921.

1,613,964. TESTING SYSTEM; W. J. Shackelton, Scotch Plains, N. J. App. filed July 25, 1923. Means and methods for accurately determining the electrical characteristics of magnetic members.

1,613,966. ELECTROLYTIC CELL; E. Sorensen, Rumford, Me. App. filed Aug. 8, 1925. Used in the production of chlorine and sodium hydroxide from brine.

1,614,008 and 1,614,009. ASYNCHRONOUS INDUCTION ELECTRIC MACHINE; V. Martinetto, Turin, Italy. Apps. filed April 25, 1922, and Jan. 23, 1924. With economic regulation of speed, starting with a good torque without inserting ohmic resistances in the secondary circuit, involving the improvement of the power factor and the possibility of constructing induction motors with a large air gap.

1,614,014. ELECTRIC FUSE; T. E. Murray, Brooklyn, N. Y. App. filed Jan. 8, 1925. Repulsion fuse.

1,614,052. ELECTRIC SWITCH; G. B. Wadsworth, Covington, Ky. App. filed Nov. 17, 1923. Safety type.

1,614,058. ELECTRIC SAFETY LOCK; H. Bienert, Beuthen, Germany. App. filed Feb. 6, 1926. A locking hook adapted to be electrically released, in which the alternating-current circuit for exciting the electromagnet may be switched in from outside or inside the house or flat, from the inside by a button or switch, from the outside by means of a contact known only to the initiated and to be adjusted by a threaded key.

1,614,092, 1,614,093. ALTERNATING-CURRENT MOTOR; H. Weichsel, St. Louis, Mo. Apps. filed May 15, 1924, and Nov. 4, 1925. Particularly self-excited synchronous motors, self-excited compensated asynchronous motors and converters, whether of the polyphase or single-phase type, to make it possible to increase the number of commutator segments for a given voltage to such an extent that sparkless operation of the machine at starting and at all loads can be secured. This is accomplished by the location and relation of windings and the construction of the magnetic circuit.

1,614,115. ELECTRIC SWITCHING APPARATUS; H. G. French, Schenectady, N. Y. App. filed Dec. 27, 1921. Particularly adapted for inclosed unit-panel construction and arranged to provide safety for apparatus and operator and accessibility for inspection and repairs.

1,614,121. ILLUMINATING UNIT; C. A. B. Halvorson, Jr., Lynn, Mass. App. filed Jan. 25, 1924. Especially adapted for industrial lighting.

1,614,141. ELECTRICAL SYSTEM; W. E. Menzies, Irwin, Pa. App. filed May 10, 1922. As employed for charging storage batteries.

1,614,142. SEGREGATED DRIVE FOR PAPER MACHINES AND THE LIKE; W. L. Merrill, Schenectady, N. Y. App. filed Feb. 9, 1920. In which a plurality of the driven elements are normally required to operate in fixed speed relation and in which it is essential that the speed of any individual element of the machine, as well as of the machine as a whole, be readily adjustable.

1,614,146. CONTROL SYSTEM; G. W. Muller, Charlottenburg, Germany. App. filed Feb. 27, 1926. For controlling the operation of a mercury-arc rectifier connected in parallel with a rotary converter or other electrical machine; has for its principal object the provision of an arrangement whereby the transmission of current through the rectifier is prevented until the machine has attained a predetermined voltage or other electrical condition.

1,614,147. AUTOMATIC SUBSTATION; G. W. Muller, Charlottenbuerg, Germany. App. filed May 11, 1926. Comprising rectifiers. An improved rectifier equipment that is provided with a regulating device controlled in accordance with the rectifier excitation which is automatically connected to and disconnected from the system in response to predetermined changes in the value of the direct-current load and is little affected by interruption of the alternating supply circuit.

1,614,155. TROLLEY WHEEL; C. H. Schafer, Sharpsburg, Pa. App. filed July 11, 1922.

1,614,161. POLYPHASE TRANSFORMER; E. C. M. Staho, Yonkers, N. Y. App. filed Jan. 20, 1922. Arrangement of the various parts of the magnetic core with respect to the paths furnished for the magnetic flux linked with the electric circuits. To provide magnetic paths for the flux from each of the coils which will be so related as to give a substantially balanced relation of the magnetic circuits and have substantially the same magnetic reluctance, even though the core structure is unsymmetrical as to the space relationship between all of the core legs carrying windings. A polyphase transformer which will not only have low core loss and high efficiency, but also low, balanced and symmetrical phase-exciting currents both effective and instantaneous.

1,614,163. LIGHTING FIXTURE; O. H. Van Amberg, Schenectady, N. Y. App. filed Jan. 28, 1921. Comprises a wall portion having a plug receptacle permanently wired to the lighting circuit and a bracket portion which is permanently wired and is adapted to be both mechanically and electrically connected to and detached from the plug receptacle as a unit.

1,614,168. ELECTRIC HEATER; C. C. Abbott, Pittsfield, Mass. App. filed April 8, 1925. Space heater with means for dissipating heat therefrom and for preventing overheating of a certain part or parts of the heater.

1,614,169. ELECTRICAL CIRCUIT BREAKER OR INTERRUPTER; E. Aichele, Irvington, N. J. App. filed Feb. 24, 1925. Made in either plug or cartridge form, respectively adapted to connection in the ordinary sockets or clips, to provide primarily a safeguard against injurious effects of abnormal overloads and short circuits.

1,614,173. ELECTROMAGNETIC SWITCH; L. M. Aspinwall, Pittsburgh, Pa. App. filed Nov. 2, 1921. For governing circuits traversed by moderately heavy currents.

1,614,174. INSTRUMENT SHUNT; W. A. Atwood, Schenectady, N. Y. App. filed April 9, 1925. Arranged so that its temperature coefficient of resistance may be readily adjusted to accommodate different instruments or other devices.

1,614,176. SWITCH; B. O. Austin, Wilkinsburg, Pa. App. filed Oct. 7, 1921. For interrupting circuits that are traversed by relatively large currents.

1,614,192. SYSTEM OF DISTANT CONTROL; H. W. Ewald, Schenectady, N. Y. App. filed July 18, 1923. Requiring a comparatively small number of wires for controlling suitable driving means to move a controlled object.

1,614,198. SYSTEM OF MOTOR CONTROL; B. W. Jones, Schenectady, N. Y. App. filed July 21, 1924. For certain applications, such as the driving of rolling mills, mine hoists and the like, in which the load is apt to vary materially.

1,614,201. TROLLEY BASE; E. A. Larsson, Mansfield, Ohio. App. filed April 17, 1924.

1,614,202. FREQUENCY METER; B. E. Lenehan, Wilkinsburg, Pa. App. filed June 6, 1924. Highly sensitive over a small range of frequency variation.

1,614,212. METERING SYSTEM; B. H. Smith, Swissvale, Pa. App. filed May 7, 1924. Remote metering systems that are adapted for use in connection with a plurality of power substations.

1,614,217. FLOW METER AND THE LIKE; L. W. Thompson, Schenectady, N. Y. App. filed Jan. 26, 1924.

1,614,219. METHOD AND APPARATUS FOR MEASURING VOLT-AMPERES IN AN ALTERNATING-CURRENT CIRCUIT; R. A. Warner, Schenectady, N. Y. App. filed Dec. 18, 1924.

1,614,222. METERING SYSTEM; T. U. White, Pittsburgh, and J. E. Gardner, Wilkinsburg, Pa. App. filed Nov. 15, 1924. Whereby a plurality of meter indications may be sent over a single circuit extending between two electrical stations or between an electrical station and a dispatcher's office; having selecting means consisting wholly of relays for associating the different meters with a single circuit.

1,614,223. REPEATING ELECTRICAL CIRCUIT INTERRUPTER; E. Aichele, Irvington, N. J. App. filed Sept. 4, 1924. In either plug or cartridge form, respectively adapted for connection in ordinary sockets and clips, to serve as a safeguard against injurious effects of abnormal overloads and short circuits.

1,614,257. MINE SIGNAL PLANT; F. Scheffler, Kiel, Germany. App. filed April 11, 1925. For controlling the hoisting operations in mines.

1,614,263. METHOD FOR MAKING ORNAMENTAL PANELS, SIGNS AND THE LIKE; W. H. Spencer, Bogota, N. J. App. filed March 18, 1926.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Investment in Electrical Industry Parallels Growth of Other National Savings

THE rapid growth of the electric light and power industry is a matter of common knowledge. It is also known that there has been a great increase in wages and general prosperity. This increase has gone in part into more luxurious living, in part into increased savings. The progress of the electrical industry has been indicated in various ways by statistics published from time to time in the ELECTRICAL WORLD. Information regarding savings has recently been presented by the National Industrial Conference Board in the form of charts, which are here reproduced in slightly modified form.

It is shown that in the eleven years since 1914 the total savings have increased two and six-tenths times and that the ratio between the three major items of savings has remained substantially unchanged. The annual increase, or, in other words, the amount of new savings each year, has reflected the fluctuations in general prosperity. The greatest variations occur in savings in banks; in fact, there are years in which current withdrawals exceed current additions. On the other hand, the greatest stability is observed in those forms of saving where the method involves a definite obligation of regularity, as in the payment of life insurance premiums and the purchase of building loan shares.

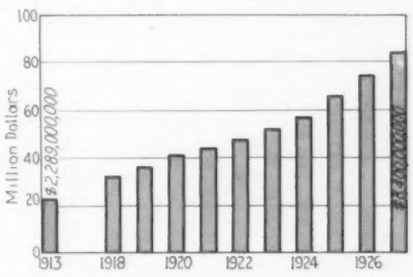
There is a rather striking parallel between gain in national savings and increase of electric light and power investments.

Investments in industrial securities are one form of savings. Increase of capitalization, at least where backed by a corresponding increase in physical property, is possible only when income exceeds expenditures in the economic structure as a whole.

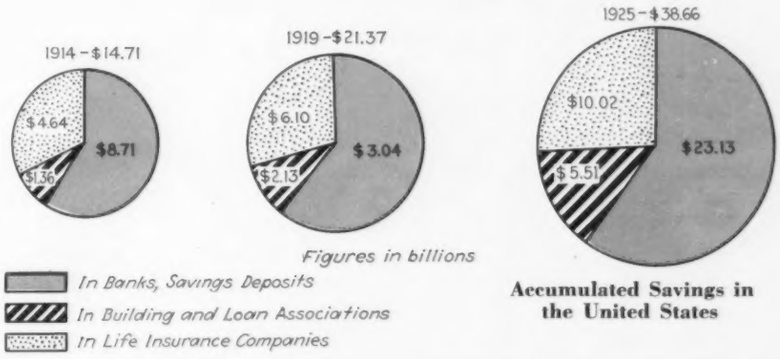
Exact figures for capitalization of the central-station industry for 1914 are not available, but the amount must have been close to $2,500,000,000. In 1925 it was about $6,000,000,000. The ratio is 2.6, the same as that shown for savings. The net yearly additions to capital, though not known for 1914, averaged about $200,000,000 for the five years from 1913 to 1918. This had increased about four and a half times by 1925, but meanwhile the annual savings were six times as great as in 1913.

If, however, the period from 1918 to 1925 is analyzed, there is a different story to tell, for total savings during those years increased by 81 per cent, while the capitalization of the central-station industry increased more than 100 per cent.

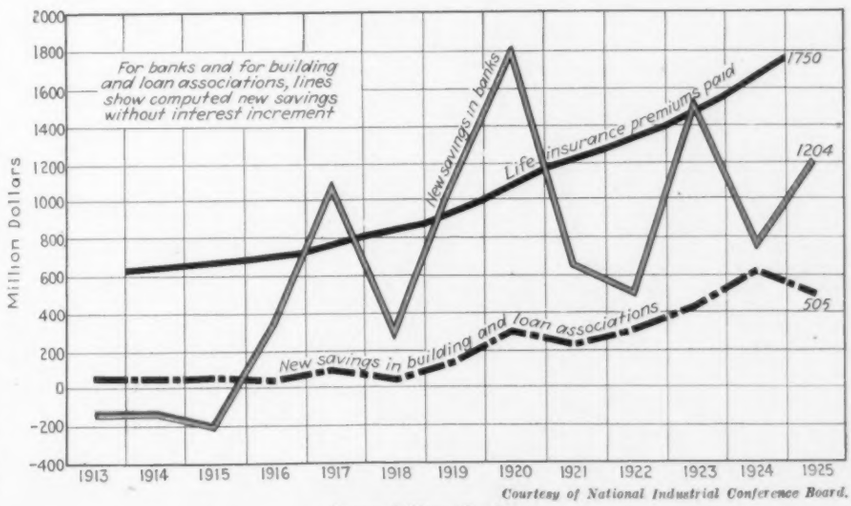
The increase in annual additions to electrical investment meanwhile ran substantially parallel with the new savings, growing about two and a half times, while additions to savings increased two and eight-tenths times.



Capitalization, Electric Light and Power Industry



Accumulated Savings in the United States



Courtesy of National Industrial Conference Board.

Annual New Savings

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

The Industrial South Develops Rapidly

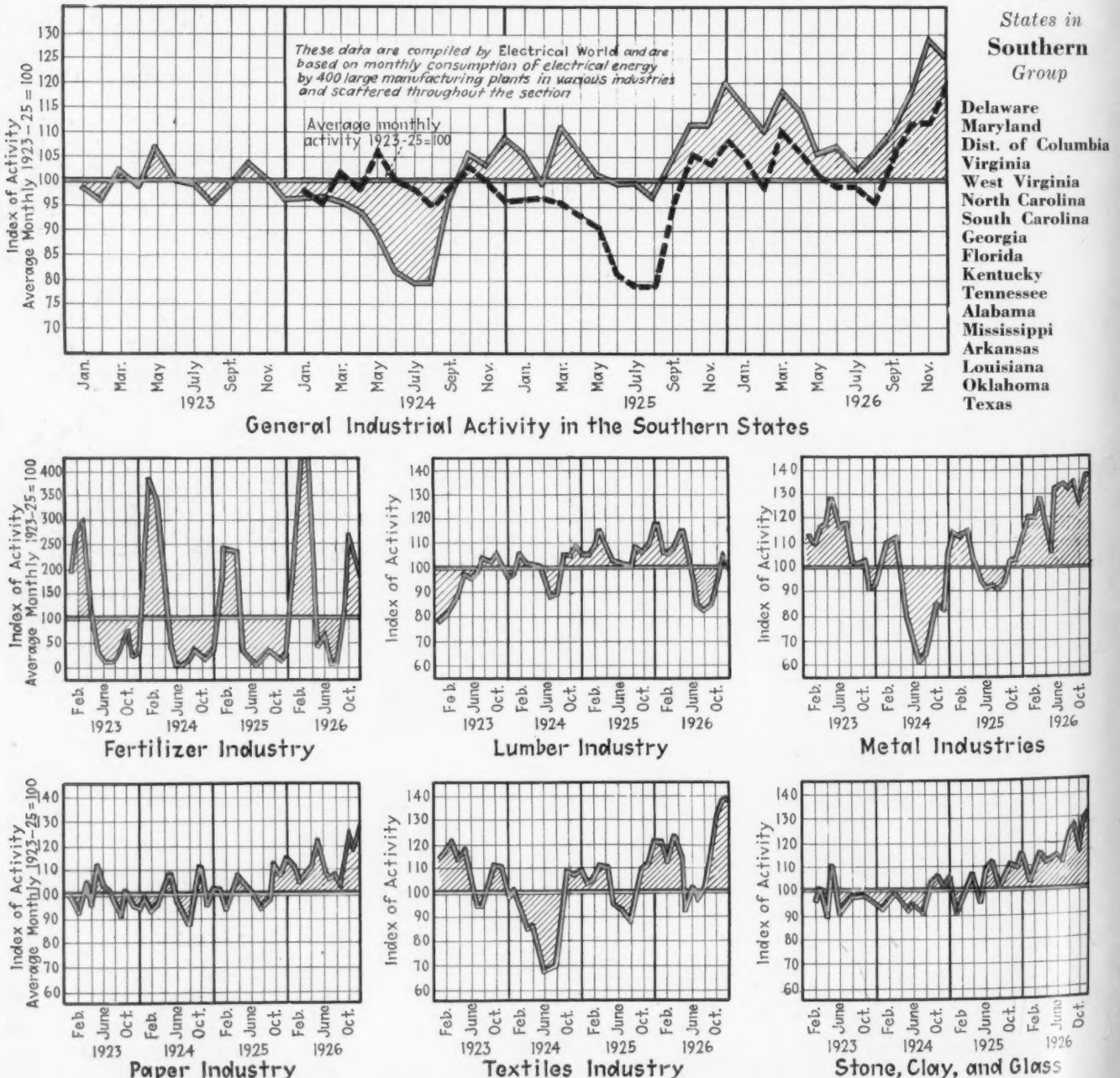
A CLEAR picture of the industrial growth of the Southern States during the past few years is to be found in the accompanying barometer of industrial operations in that section, based upon the consumption of electrical energy by the manufacturing plants. The year just closed witnessed monthly production activities of the manufacturing plants in this section consistently above the monthly average for the three-year period 1923-1925. No other section of the country reported production operations during 1926 as high in comparison with the monthly average for the three-year period.

All primary industries with the exception of lumber were operating during 1926 above the operations for the year previous.

An even more significant point is that the monthly productive operations of general industry in this section have been above the operations for the same month of the previous year ever since September, 1924. These facts are, indeed, a vivid picture of the industrial development of the Southern States during the past few years.

The continually increasing productive operations of the iron and steel mills are largely responsible for the large increase in total operations. The same iron and steel plants increased their production operations from January, 1926, to December, 1926, by almost 13 per cent, the November operations being the highest in the history of the iron and steel industry of this section. December productive operations of the iron and steel plants were slightly under those of November after correction for number of working days is made.

Operations in the textile plants of the section were especially high during the last quarter of the year, the December operations being the greatest in the history of that industry in this section. The fertilizer industry appears to have reached its peak of productive activity in October. The lumber industry has reflected the gradual recession in residential construction witnessed during the year throughout the country.

"Electrical World" Barometer of Industrial Activity in the Southern States

(Data Unadjusted to Seasonal Variations)